Version 2.0

BEANAIR

# BEANDEVICE® PROCESSSENSOR USER MANUAL

***AN-420 / AN-mV/AN-V & Xtender***

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# 1. TECHNICAL SUPPORT

For general contact, technical support, to report documentation errors and to order manuals, contact ***BeanAir Technical Support Center*** (BTSC) at:
tech-support@beanair.com

For detailed information about where you can buy the BeanAir equipment/software or for recommendations on accessories and components visit:

www.beanair.com

To register for product news and announcements or for product questions contact BeanAir's Technical Support Center (BTSC).

Our aim is to make this user manual as helpful as possible. Please keep us informed of your comments and suggestions for improvements. BeanAir appreciates feedback from the users.

# 1. VISUAL SYMBOLS DEFINITION

| Symbols | Definition |
| --- | --- |
| | ***Caution or Warning** – Alerts the user with important information about BeanAir wireless sensor networks (WSN), if this information is not followed, the equipment /software may fail or malfunction.* |
| | ***Danger** – This information MUST be followed if not you may damage the equipment permanently or bodily injury may occur.* |
| | ***Tip or Information** – Provides advice and suggestions that may be useful when installing BeanAir Wireless Sensor Networks.* |

## 2. ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| *AES* | Advanced Encryption Standard |
| *CCA* | Clear Channel Assessment |
| *CSMA/CA* | Carrier Sense Multiple Access/Collision Avoidance |
| *GTS* | Guaranteed Time-Slot |
| *kSps* | Kilo samples per second |
| *LLC* | Logical Link Control |
| *LQI* | Link quality indicator |
| *LDCDA* | Low duty cycle data acquisition |
| *MAC* | Media Access Control |
| *PAN* | Personal Area Network |
| *PER* | Packet error rate |
| *RF* | Radio Frequency |
| *SD* | Secure Digital |
| *WSN* | Wireless sensor Network |

# 3. RELATED DOCUMENTS & VIDEOS

In addition to this User manual, please consult the related application notes, technical notes and videos:

## 3.1 APPLICATIONS NOTES

| Document name (Click on the weblink) | Related product | Description |
|---|---|---|
| AN_RF_007 :" Beanair_WSN_Deployment" | All BeanAir products | Wireless sensor networks deployment guidelines |
| AN_RF_006 – „How to extend your wireless range" | All BeanAir products | A guideline very useful for extending your wireless range |
| AN_RF_005 – BeanGateway® & Data Terminal Equipment Interface | BeanGateway® | DTE interface Architecture on the BeanGateway® |
| AN_RF_004 – "Coexistence And Interferences@2.4GHz" | All BeanAir products | Coexistence & interferences of different RF technologies in the 2.4 GHz frequencies band. |
| AN_RF_003 - "IEEE 802.15.4 2.4 GHz V: 868 MHz" | All BeanAir products | Comparison between 868 MHz frequency band and a 2.4 GHz frequency band. |
| AN_RF_002 – "Structural Health monitoring on bridges" | All BeanAir products | The aim of this document is to overview Beanair® products suited for bridge monitoring, their deployment, as well as their capacity and limits by overviewing various data acquisition modes available on each BeanDevice®. |

## 3.2 TECHNICAL NOTES

| Document name (Click on the weblink) | Affected product | Description |
|---|---|---|
| TN_RF_010 – « BeanDevice® Power Management » | All the BeanDevice® | This technical note describes the sleeping & active power mode on the BeanDevice®. |
| TN_RF_009 – « BeanGateway® management on LAN infrastructure » | BeanGateway® | BeanGateway® integration on a LAN infrastructure |
| TN_RF_008 – "Data acquisition modes available on the BeanDevice®" | All the BeanDevice® | Data acquisition modes available on the BeanDevice® |
| TN_RF_007 – "BeanDevice® DataLogger User Guide " | All the BeanDevice® | This document presents the DataLogger feature on the BeanDevice® |
| TN_RF_006 – "WSN Association process" | All the BeanDevice® | Description of the BeanDevice® network association |
| TN_RF_005 – "Pulse counter & binary data acquisition on the BeanDevice® SUN-BN" | BeanDevice® SUN-BN | This document presents Pulse counter (ex: energy metering application) and binary data acquisition features on the BeanDevice® SUN-BN. |
| TN_RF_004 - Ambient Light sensor technical specifications | BeanDevice® SUN-XX (Ecosensor) | Technical description of the Ambient light sensor available on the BeanDevice® SUN-XX products |
| F_TN_003 V1.0- "Wireless Network capacity" | All the products | Network capacity characterization of Beanair Wireless Sensor Networks |
| F_TN_002 V1.0 - Current consumption in active & sleeping mode | BeanDevice® | Current consumption estimation of the BeanDevice in active and sleeping mode |

| | | |
|---|---|---|
| *I F_TN_001 V1.0- Wireless range benchmarking* | BeanDevice® | Wireless range benchmarking of the BeanDevice® |

## 3.3 RELATED VIDEOS

### 3.3.1 Beanair product introduction videos

*All the videos are available on our Youtube channel*

| Web link | Related products |
|---|---|
| *Company Presentation* | *All* |
| *BeanGateway® - Ethernet Outdoor version introduction* | *BeanGateway® - Ethernet Outdoor version introduction* |
| *BeanGateway® – Ethernet Indoor version introduction* | *BeanGateway® Ethernet Indoor version* |
| *BeanDevice® AN-XX introduction* | *BeanDevice® AN-XX & Beandevice® AN-XX Extender* |
| *BeanDevice® AX-3D introduction* | *BeanDevice® AX-3D* |
| *BeanDevice® HI-INC introduction* | *BeanDevice® HI-INC* |
| *BeanDevice® AX-3DS introduction* | *BeanDevice® AX-3DS* |
| *BeanDevice® SUN-T introduction* | *BeanDevice® SUN-T* |
| *BeanDevice® SUN-TH introduction* | *BeanDevice® SUN-TH* |
| *BeanDevice® SUN-TIR introduction* | *Beandevice® SUN-TIR* |
| *BeanDevice® SUN-BN introduction* | *BeanDevice® SUN-BN* |
| *BeanDevice® SUN introduction* | *BeanDevice® SUN* |

### 3.3.2 BeanGateway® Tutorial Videos

| Web link | Related products |
|---|---|

| | |
|---|---|
| *BeanGateway® Ethernet/LAN Configuration, directly connected to the Laptop/PC* | *BeanGateway®* |
| *Performing an energy scan on your BeanGateway®* | *BeanGateway®* |
| *Automatic RF Channel selection* | *BeanGateway®* |
| *Wireless sensors profile deletion from the BeanGateway® Database* | *All* |
| *Network Diagnostic configuration on the BeanGateway®* | *BeanGateway®* |
| *RF Power configuration on the BeanGateway®* | *BeanGateway®* |

### 3.3.3 BeanDevice® Tutorial Videos

| *Web link* | *Related products* |
|---|---|
| *Change your sensor measurement unit* | *All the BeanDevice®* |
| *Perform a buffer reset* | *All the BeanDevice®* |
| *How to change the data acquisition cycle ? (LDCDA)* | *All the BeanDevice®* |
| *Beandevice® AN-XX wireless range demonstration* | *BeanDevice® AN-XX & Beandevice® AN-XX Extender* |

### 3.3.4 BeanScape® Tutorial Videos

| *Web link* | *Related products* |
|---|---|
| *BeanScape® – WSN supervision software* | *BeanScape®* |

## 4. BEANDEVICE® VERSIONS

| | Hardware | Embedded Software | Wireless Stack |
|---|---|---|---|
| ***BeanDevice® AN-XX*** | V1.4 | ***V1.3*** - Binary sensor management<br>***V1.4*** - Gain adaptation on the ALS<br>***V1.5*** - Calibration feature implemented on all the Beandevice<br>***V1.6*** - DataLogger feature with Radio sleep/active management | IEEE 802.15.4 V2006 |

***These ID versions should be transmitted to our technical support center when you encountered a material or software dysfunction.***

## 5. DOCUMENT ORGANISATION

This manual is organized in 7 chapters, as follows:

| | |
|---|---|
| BeanDevice® product overview | •Details the BeanDevice® product presentation |
| Data acquisition mode description | •Details the data acquisition mode available on the BeanDevice®<br>• ***Related Technical Note:*** TN_RF_008 - "Data acquisition mode available on the BeanDevice®" |
| BeanDevice® installation guidelines | •Details the installation guidelines of the BeanDevice®<br>•***Related Technical Note:*** TN_RF_010 - "Beandevice® Power Management "<br>•***Related Technical Note:*** TN_RF_007- "Beandevice® DataLogger user Guide"<br>•***Related Technical Note:*** TN_RF_006- "Beandevice® wireless network association" |
| BeanDevice® supervision from the Beanscape® | •Details the BeanDevice® supervision from the BeanScape® |
| BeanDevice® maintenance (for experienced user) | •Details the BeanDevice® maintenance (for experienced user) |
| Troubleshooting | •Frequently asked questions (FAQ) |
| Installation procedures | •Details the installation procedures |

# 6. BEANDEVICE® PRODUCT OVERVIEW

***It is highly recommended to read all the user manual related to BeanAir software & equipment (BeanScape ®, BeanGateway®, BeanDevice ®) before getting start your BeanDevice®.***

## 6.1 INTRODUCTION TO PROCESSSENSOR PRODUCT LINES

BeanDevice® ProcessSensor sensor product lines were designed by our research and development team in order to be adapted for analog measurement (4-20 mA, ±5V, ±10V, ±20mV, ±40mV) in harsh industrial environment.

These products offer the following advanced features:

- System data acquisition for external analog sensors
- Providing power supply to external industrial sensors
- Back Up data acquisition on an internal flash memory (embedded dataLogger)
- Transmitting data by wireless
- Manage sleep or activation mode

| | |
|---|---|
| **BeanDevice® AN-420 & BeanDevice® AN-420 Xtender** | Wireless system acquisition for analog 4-20 mA current loop measurement. |
| **BeanDevice® AN-V & BeanDevice® AN-V Xtender** | Wireless system acquisition for analog differential measurement ±5 volts or ±10 volts. |
| **BeanDevice® AN-mV** | Wireless system acquisition for analog differential measurement ±20 mV<br>This product is dedicated to sensors integrating a Wheatstone bridge (strain gauge sensors, load cell sensors, pressure…). |

***Industrial sensors commonly use a 4-20 mA DC signal. With this method, the sensor signal is conveyed as a current. Raw output of the sensor will either be 4 mA at the lowest or 20 mA at the highest. By examining the current between 4 and 20 mA an actual reading can be determined. For example, assume an air temperature sensor has a range of 0°C to 100°C. If the output from the temperature sensor is 4 mA, then the temperature is 0°C. If the output from the sensor is 20 mA, then the temperature is 100°C. Readings between 4 and 20 mA are linear and simple to determine.***

*One of the major advantages of using 4-20 mA sensors is the limited signal loss of these devices. By outputting a sensor signal in the form of current, electrically noisy areas do not have an effect on the sensor's readings. Furthermore, accuracy is not affected by changes in line and connection resistance, or by the addition of other loads in the circuit.*

## 6.2 ADVANTAGES OF USING THE BEANDEVICE® AN-XX XTENDER

The Beandevice® AN-XX Xtender uses a Primary cell (5800 mAh) instead of a rechargeable battery (950mAh), it provides a better battery autonomy.

This product is ideal for telemetry applications on remote sites (Greenhouses, Water treatment plant, water intake…).

## 6.3 BEANDEVICE® TECHNICAL SPECIFICATIONS

### 6.3.1 Common technical specifications

6.3.1.1 RF specifications

| | RF Specifications |
|---|---|
| **Wireless Protocol Stack** | IEEE 802.15.4 (2006 version) |
| **WSN Topology** | Point-to-Point / Star |
| **Encryption** | AES 128 bits (AES integrated coprocessor) |
| **Data rate** | 250 Kbits/s |
| **RF Characteristics** | ISM 2.4GHz – 16 Channels. Antenna diversity architecture designed by BeanAir® |
| **TX Power** | +0 dBm to +18 dBm |
| **Receiver Sensitivity** | -95,5 dBm to -104 dBm |
| **Maximum Radio Range** | 1 Km (L.O.S) |
| **Antenna** | Antenna diversity : 2 omnidirectional N-Type antenna with a gain of 2.2 dBi<br>Degree of protection IP67 |

***Table 1: RF specifications Table***

6.3.1.2 Others specifications (BeanDevice® AN-XX only)

| | Others specifications |
|---|---|
| **Embedded logger** | • Storage Capacity : up to 1 000 000 measurements<br>• Integrated real time clock<br>• Write/read Cycle: 400 000 |
| **Integrated battery charger** | Integrated Lithium-ion battery charger with high precision battery monitoring :<br>• Overvoltage Protection, Overcurrent/Short-Circuit Protection, Undervoltage Protection<br>• Battery Temperature monitoring<br>• Current accumulation measurement |
| **Current consumption** | • During data acquisition : 70mA to 130 mA (depends on external sensor power consumption)<br>• During Radio transmission : 60 mA @ 0dBm<br>• During sleeping: < 45 uA |
| **Operating Temperature** | -20 °C to +75 °C - Integrated temperature sensor (resolution 0.125°C) |
| **Enclosure** | Aluminium, Watertight IP65 – Fire Protection : ULV94/Getex<br>Enclosure dimensions (without antenna ) L x l x h : 146.05 mm x 65.5mm x 33.5 mm |
| **Shocks resistance** | 10g during 50 ms |
| **Norms** | CE Labelling Directive R&TTE (Radio) ETSI EN 300 328<br>ROHS - Directive 2002/95/EC |
| **External power supply** | External power supply : +8v to +28v |
| **Rechargeable battery** | Lithium-Ion high density rechargeable battery capacity of 950 mAh |
| **Power-supply bloc (Option)** | Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67) |
| **Mechanical mounting (Option)** | DIN Rail mounting |

### 6.3.2 BeanDevice® AN-420 & AN-420 XTender

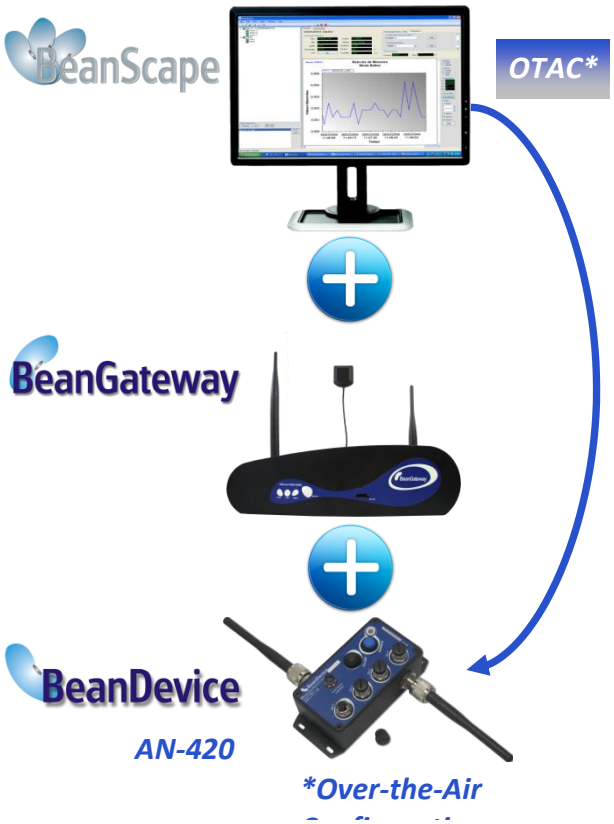
#### 6.3.2.1 Product reference

| *Product reference* | |
|---|---|
| BND-A420 -*N*CH -*WP*-*BT* | |
| ***N*- *Number of data acquisition channels*** :<br>- ***2*** : 2 Channels<br>- ***4*** : 4 Channels | ***WP– Wireless Protocol***<br>- ***IEEE*** : IEEE 802.15.4 (2006) |
| Example : BND-AN420 –*4*CH *-IEEE*<br>***BeanDevice® AN-420 with four channels , IEEE 802.15.4(2006) , Rechargeable battery*** | |

#### 6.3.2.2 Analog data acquisition block specifications

| | Analog data acquisition block specifications |
|---|---|
| **Signal Conditionning** | Analog current loop measurement |
| **Number of channels** | 2 or 4 Channels |
| **A/D Converter** | 16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation |
| **Measurement range** | 4-20 mA Current Loop measurement |
| **Non-linearity error** | ± 0,5 LSB |
| **Measurement accuracy** | < 0,1% when the BeanDevice is connected to an external power supply<br>< 0,08% when the BeanDevice operates on battery |
| **Sensor Connector** | M12-5Pins, degree of protection IP67 |

6.3.2.3 OTAC Parameter




The BeanScape® application allows the user to view all the data measurements transmitted by the **BeanDevice® AN-420** .

With the OTAC (Over-the-Air configuration) feature, the user can remotely configure the **BeanDevice® AN-420**

Several Data acquisition modes are available on the **BeanDevice® AN-420** :

- **Low Duty Cycle Data Acquisition mode (LDCDA)**: the data acquisition is immediately transmitted by radio. The transmission frequency can be configured from 1s to 24h.
- **Alarm Mode** : the measured value is transmitted by radio whenever an alarm threshold (fixed by the user) is detected (4 alarms threshold levels High/Low).
- **Survey Mode** : operates like the Alarm mode but the device sends frequently a beacon frame informing its current status.
- **Streaming Packet Mode**: All measured values are transmitted by packet within a continuous flow at 400 samples per second maximum

| | Over-the-air configuration (OTAC) parameters |
|---|---|
| **Data Acquisition mode** | ***Low Duty Cycle Data Acquisition (LDCDA) Mode***: 1s to 24 hour<br>***Alarm & Survey mode***: 1s to 24 hour<br>***Math Mode*** : 400 SPS maximum<br>***Streaming Packet Mode***: 400 SPS maximum<br>***Streaming Mode:*** 100 SPS maximum |
| **Sampling Rate (SPS = sample per** | Minimum***: 1 SPS*** |

| | |
|---|---|
| **second)** | Maximum***: 400 SPS*** maximum on each channel |
| **Alarm Threshold** | 2 high levels alarms & 2 low levels alarms |
| **Sensor power supply** | ***4.5 to 20 Volts*** |
| **Power Mode** | Sleeping, Sleeping with Network Listening & Active |
| **TX Power** | -7 dBm / -1 dBm / 5 dBm / 11 dBm / 15 dBm / 18 dBm |

**.3.3 ean Dev ice ® AN-mV & AN-mV Xtender**

6.3.3.1 Product reference

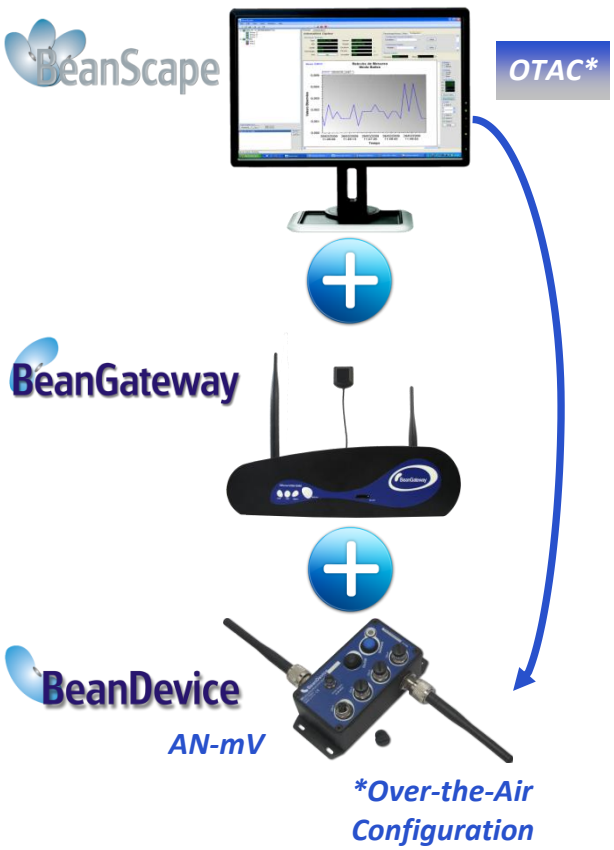
| ***Product reference*** | |
|---|---|
| BND-ANmV –***N***CH –***MR-WP-BB*** | |
| ***N- Number of data acquisition channels*** :<br>- ***2*** : 2 Channels | ***MR-measurement range***<br>- ***20*** : ±20mV measurement range<br>- ***40***: ±40mV measurement range |
| ***WP– Wireless Protocol***<br>- ***IEEE*** : IEEE 802.15.4 (2006) | ***BB– Battery Type***<br>- ***RB***: rechargeable battery |
| Example : BND-ANMV –***2***CH –***20-IEEE-RB***<br>***BeanDevice® AN-mV with two channels , measurement range ± 20mV IEEE 802.15.4(2006) , Rechargeable battery*** | |

6.3.3.2 Analog data acquisition block specifications

| | **Analog data acquisition block specifications** |
|---|---|
| **Signal Conditionning** | Analog low voltage mV **with voltage-compensated measurement** |
| **Number of channels** | 2 Channels |
| **A/D Converter** | 16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation |
| **Measurement range** | ±20 mV (bipolar) or 0-40 mV (unipolar)<br>±-40 mV (bipolar) or 0-80mV (unipolar) |
| **Non-linearity error** | ± 0,5 LSB |

| | |
|---|---|
| **Measurement accuracy** | < 0,2% when the BeanDevice is connected to an external power supply<br>< 0,1% when the BeanDevice operates on battery |
| **Sensor Connector** | M12-5Pins, degree of protection IP67 |

6.3.3.3 OTAC Parameter




The BeanScape® application allows the user to view all the data transmitted by the **BeanDevice® AN-mV** .

With the OTAC (Over-the-Air configuration) feature, the user can remotely configure the **BeanDevice® AN-mV**

Several Data acquisition modes are available on the **BeanDevice® AN-mV** :

- **Low Duty Cycle Data Acquisition mode (LDCDA)**: the data acquisition is immediately transmitted by radio. The transmission frequency can be configured from 1s to 24h.
- **Alarm Mode** : the measured value is transmitted by radio whenever the threshold level is reached (determined by the user, 4 alarm threshold levels High/Low).
- **Survey Mode** : operates like the Alarm Mode but the device sends frequently a beacon frame informing its current status.
- **Streaming Packet Mode**: All measured values are transmitted by packet within a continuous flow at 400 Hz maximum
- **Streaming Mode**: all measured values are

| | Over-the-air configuration (OTAC) parameters |
|---|---|
| **Data Acquisition mode** | ***Low Duty Cycle Data Acquisition (LDCDA) Mode***: 1s to 24 hour<br>***Alarm & Survey mode***: 1s to 24 hour<br>***Math Mode*** : 400 SPS maximum<br>***Streaming Packet Mode***: 400 SPS maximum<br>***Streaming Mode:*** 100 SPS maximum |
| **Sampling Rate (SPS = sample per second)** | Minimum***: 1 SPS***<br>Maximum***: 400 SPS*** maximum on each channel |
| **Alarm Threshold** | 2 high levels alarms & 2 low levels alarms |
| **Sensor power supply** | ***4.5 to 20 Volts*** |
| **Power Mode** | Sleeping, Sleeping with Network Listening & Active |
| **TX Power** | -7 dBm / -1 dBm / 5 dBm / 11 dBm / 15 dBm / 18 dBm |

### 6.3.4 BeanDevice® AN-V & AN-V Xtender

#### 6.3.4.1 Product reference

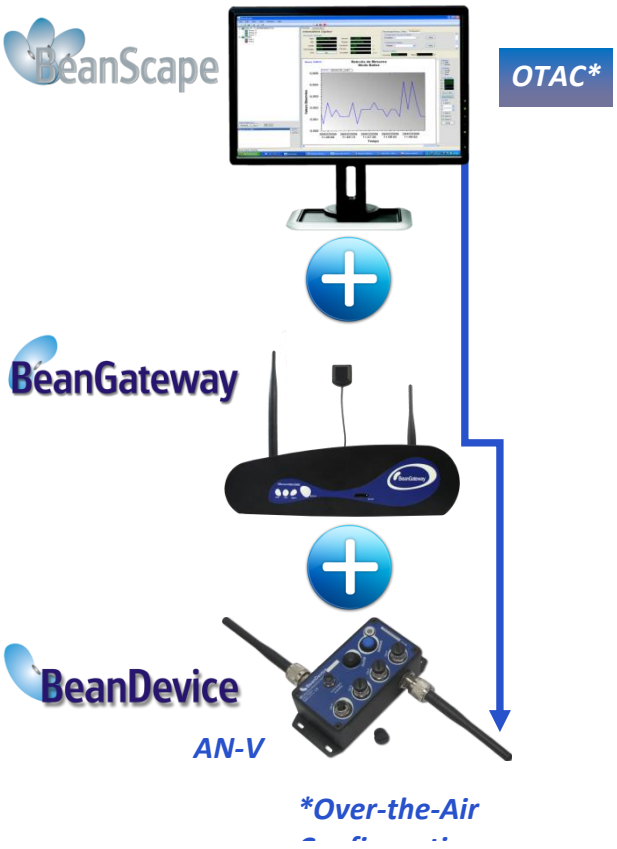
| *Product reference* | |
|---|---|
| BND-ANV –*N*CH –*MR*-*WP*-*BT* | |
| ***N*- *Number of data acquisition channels*** :<br>- ***2*** : 2 Channels<br>- ***4*** : 4 Channels | ***MR*-*Measurement Range***<br>- ***5*** : ±5V measurement range<br>- ***10***: ±10V measurement range |
| ***WP– Wireless Protocol***<br>- ***IEEE*** : IEEE 802.15.4 (2006) | ***BT– Battery Type***<br>- ***RB***: rechargeable battery |
| ***Example 1*** : BND-ANV –2CH –5-IEEE-RB<br>***BeanDevice® AN-V with two channels , measurement range: ±5V , IEEE 802.15.4(2006) , Rechargeable battery***<br>***Example 2***: BND-ANV –4CH –10-IEEE-RB<br>***BeanDevice® AN-V with four channels , measurement range: ±10V , IEEE 802.15.4(2006) , Rechargeable battery*** | |

#### 6.3.4.2 Analog data acquisition block specifications

| | Analog data acquisition block specifications |
|---|---|
| **Signal Conditionning** | Analog voltage measurement |
| **Number of channels** | 2 or 4 Channels |
| **A/D Converter** | 16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation |
| **Measurement range** (analog polarity is configurable from the BeanScape®) | RBND-ANV –NCH –5-IEEE-BT: ±5V (bipolar) or 0-10 V (unipolar) |
| | BND-ANV –NCH –10-IEEE-BT: ±10V (bipolar) or 0-20 V (unipolar) |
| **Non-linearity error** | ± 0,5 LSB |

| | |
|---|---|
| **Measurement accuracy** | < 0,1% when the BeanDevice is connected to an external power supply<br>< 0,08% when the BeanDevice operates on battery |
| **Sensor Connector** | M12-5Pins, degree of protection IP67 |

6.3.4.3 OTAC Parameter




The BeanScape® application allows the user to view all the data measurements transmitted by the **BeanDevice® AN-V** .
With the OTAC (Over-the-Air configuration) feature, the user can remotely configure the **BeanDevice® AN-V**
Several Data acquisition modes are available on the **BeanDevice® AN-V** :

- **Low Duty Cycle Data Acquisition mode (LDCDA)**: the data acquisition is immediately transmitted by radio. The transmission frequency can be configured from 1s to 24h.
- **Alarm Mode** : the measured value is transmitted by radio whenever an alarm threshold (fixed by the user) is detected (4 alarms threshold levels High/Low).
- **Survey Mode** : operates like the Alarm mode but the device sends frequently a beacon frame informing its current status.
- **Streaming Packet Mode**: All measured values are transmitted by packet within a continuous flow at 400 samples per second maximum
- **Streaming Mode**: all measured values are

| | Over-the-air configuration (OTAC) parameters |
|---|---|
| **Data Acquisition mode** | ***Low Duty Cycle Data Acquisition (LDCDA) Mode***: 1s to 24 hour<br>***Alarm & Survey mode***: 1s to 24 hour<br>***Math Mode*** : 400 SPS maximum<br>***Streaming Packet Mode***: 400 SPS maximum |

| | |
|---|---|
| | ***Streaming Mode:*** 100 SPS maximum |
| **Sampling Rate (SPS = sample per second)** | Minimum***: 1 SPS***<br>Maximum***: 400 SPS*** maximum on each channel |
| **Alarm Threshold** | 2 high levels alarms & 2 low levels alarms |
| **Sensor power supply** | ***4.5 to 20 Volts*** |
| **Power Mode** | Sleeping, Sleeping with Network Listening & Active |
| **TX Power** | -7 dBm / -1 dBm / 5 dBm / 11 dBm / 15 dBm / 18 dBm |

## 6.4 TECHNICAL SPECIFICATIONS

### 6.4.1 Common Specifications

#### 6.4.1.1 RF specifications

| | RF Specifications |
|---|---|
| **Wireless Protocol Stack** | IEEE 802.15.4 (2006 version) |
| **WSN Topology** | Point-to-Point / Star |
| **Encryption** | AES 128 bits (AES integrated coprocessor) |
| **Data rate** | 250 Kbits/s |
| **RF Characteristics** | ISM 2.4GHz – 16 Channels. Antenna diversity architecture designed by BeanAir® |
| **TX Power** | +0 dBm to +18 dBm |

| | |
|---|---|
| **Receiver Sensitivity** | -95,5 dBm to -104 dBm |
| **Maximum Radio Range** | 1 Km (L.O.S) |
| **Antenna** | Antenna diversity : 2 omnidirectional N-Type antenna with a gain of 2.2 dBi<br>Degree of protection IP67 |

6.4.1.2 Other specifications

| | **Others specifications** |
|---|---|
| **Embedded logger** | • Storage Capacity : up to 1 000 000 measurements<br>• Integrated real time clock<br>• Write/read Cycle: 400 000 |
| **Integrated battery charger** | Integrated Lithium-ion battery charger with high precision battery monitoring :<br>• Overvoltage Protection, Overcurrent/Short-Circuit Protection, Undervoltage Protection<br>• Battery Temperature monitoring<br>• Current accumulation measurement |
| **Current consumption** | • During data acquisition : 70mA to 130 mA (depends on external sensor power consumption)<br>• During Radio transmission : 60 mA @ 0dBm<br>• During sleeping: < 45 uA |
| **Operating Temperature** | -20 °C to +75 °C - Integrated temperature sensor (resolution 0.125°C) |
| **Enclosure** | Aluminium, Watertight IP65 – Fire Protection : ULV94/Getex<br>Enclosure dimensions (without antenna ) L x l x h : 146.05 mm x 65.5mm x 33.5 mm |
| **Shocks resistance** | 10g during 50 ms |
| **Norms** | CE Labelling Directive R&TTE (Radio) ETSI EN 300 328<br>ROHS - Directive 2002/95/EC |
| **External power supply** | External power supply : +8v to +28v |
| **Rechargeable battery** | Lithium-Ion high density rechargeable battery capacity of 950 mAh |
| **Power-supply bloc** | Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug |

| | |
|---|---|
| **(Option)** | (IP67) |
| **Mechanical mounting (Option)** | DIN Rail mounting |

### 6.4.2 BeanDevice® AN-420 & AN-420 Xtender

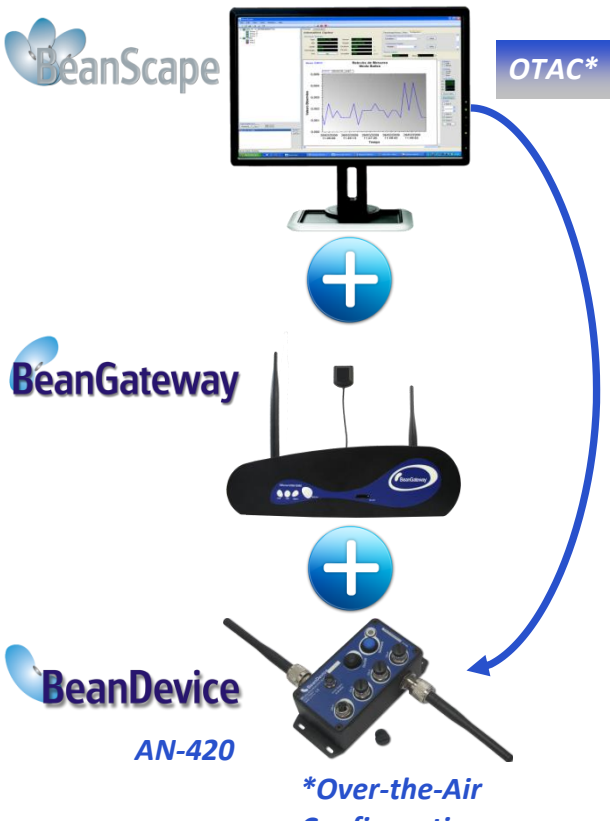
#### 6.4.2.1 Product reference

| *Product reference* | |
|---|---|
| BND-A420 -*N*CH -*WP*-*BT* | |
| ***N*- *Number of data acquisition channels*** :<br>- ***2*** : 2 Channels<br>- ***4*** : 4 Channels | ***WP– Wireless Protocol***<br>- ***IEEE*** : IEEE 802.15.4 (2006) |
| Example : BND-AN420 –***4***CH ***-IEEE***<br>***BeanDevice® AN-420 with four channels , IEEE 802.15.4(2006) , Rechargeable battery*** | |

#### 6.4.2.2 Analog Data Acquisition specifications

| | BeanDevice® AN-420- analog data acquisition specifications |
|---|---|
| **Signal Conditionning** | Analog current loop measurement |
| **Number of channels** | 2 or 4 Channels |
| **A/D Converter** | 16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation |
| **Measurement range** | 4-20 mA Current Loop measurement |
| **Non-linearity error** | ± 0,5 LSB |
| **Measurement accuracy** | < 0,1% when the BeanDevice is connected to an external power supply<br>< 0,08% when the BeanDevice operates on battery |
| **Sensor Connector** | M12-5Pins, degree of protection IP67 |

6.4.2.3 OTAC parameters




The BeanScape® application allows the user to view all the data measurements transmitted by the **BeanDevice® AN-420** .

With the OTAC (Over-the-Air configuration) feature, the user can remotely configure the **BeanDevice® AN-420**

Several Data acquisition modes are available on the **BeanDevice® AN-420** :

- **Low Duty Cycle Data Acquisition mode (LDCDA)**: the data acquisition is immediately transmitted by radio. The transmission frequency can be configured from 1s to 24h.
- **Alarm Mode** : the measured value is transmitted by radio whenever an alarm threshold (fixed by the user) is detected (4 alarms threshold levels High/Low).
- **Survey Mode** : operates like the Alarm mode but the device sends frequently a beacon frame informing its current status.
- **Streaming Packet Mode**: All measured values are transmitted by packet within a continuous flow at 400 samples per second maximum
- **Streaming Mode**: all measured values are

| | Over-the-air configuration (OTAC) parameters |
|---|---|
| **Data Acquisition mode** | ***Low Duty Cycle Data Acquisition (LDCDA) Mode***: 1s to 24 hour<br>***Alarm & Survey mode***: 1s to 24 hour<br>***Math Mode*** : 400 SPS maximum<br>***Streaming Packet Mode***: 400 SPS maximum<br>***Streaming Mode:*** 100 SPS maximum |
| **Sampling Rate (SPS = sample per second)** | Minimum***: 1 SPS***<br>Maximum***: 400 SPS*** maximum on each channel |
| **Alarm Threshold** | 2 high levels alarms & 2 low levels alarms |
| **Sensor power supply** | ***4.5 to 20 Volts*** |
| **Power Mode** | Sleeping, Sleeping with Network Listening & Active |
| **TX Power** | -7 dBm / -1 dBm / 5 dBm / 11 dBm / 15 dBm / 18 dBm |

## 6.5 PRODUCT FOCUS: BEANDEVICE® AN-MV/AN-V/AN-420

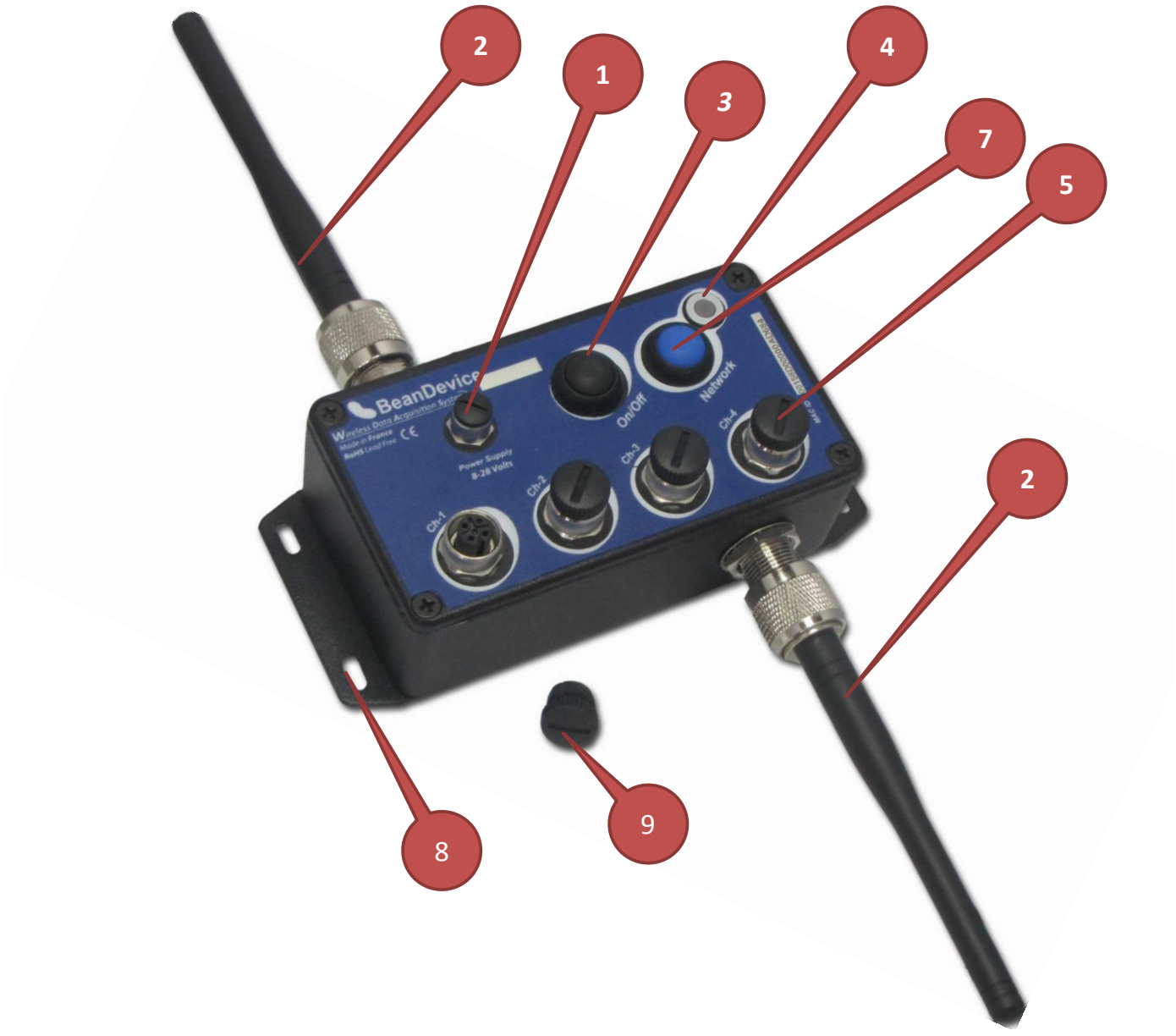



*Figure 1: Focus on BeanDevice® AN-V/AN-mV/AN-420*

| Number | Function | Description |
|---|---|---|
| 1 | ***M8-3 Contacts Socket for external power supply*** | ***DC 8-28 volts*** power supply<br>The socket sealing is assured with a screw cap<br>***Don't forget to protect the M8-3contacts socket with a screw cap. You will lose the tightness of your device if you do not close properly.*** |
| 2 | ***Radio antenna*** | 2x N-Type Radio antenna antenna , waterproof IP67<br>***Do not try to change or modify the antenna, you will damage your BeanDevice®.*** |
| 3 | ***ON/OFF push button*** | Allows to power up/power off the BeanDevice®<br>**ON : button pushed**<br>**OFF : button not pushed**<br>***Wait for a minimum of 5 seconds before your power-up the BeanDevice®. The BeanDevice® integrates an energy tank allowing a backup of the WSN context before powering OFF.*** |
| 4 | ***BeanDevice® Activity /Failure led*** | Bi-color **GREEN** / **RED Led**<br>Cf. Table for led description |
| 5 | ***M12-5 Pins female socket for sensor interface*** | This socket is compatible with a M12-5 Pins A-Coding male plug. |
| 6 | ***BeanDevice® product version label*** | Three label version are available :<br>***AN-420*** : 4-20 mA current loop measurement<br>***AN-V*** : +/-5 volts or +/-10 volts analog measurement<br>***AN-mV*** : +/- 20 mV or +/-40 mV analog low voltage measurement |
| 7 | ***Network context push button*** | To restore default/factory parameters, you must perform a ***Network context deletion***. Push on the push-button ("Network") for more than 2 seconds. |

| | | |
|---|---|---|
| | | |
| 8 | ***Eyelet for wall mounting*** | The BeanDevice® is provided with a wall mounting kit. |
| 9 | ***M12 sensor cap*** | M12 sensor cap<br> ***Don't forget to protect the M12 contacts socket with a screw cap. You will lose the tightness of your device if you do not close properly.*** |
| 10 | ***MAC ID Label*** | Unique identifier assigned to the BeanDevice® (64-bytes)<br> ***Every wireless network product which is based on the IEEE 802.15.4 standard must have a 64-bit MAC address that allows unique identification of the device within a global network.*** |

## 6.6 PRODUCT FOCUS : BEANDEVICE® AN-420/AN-V/AN-MV XTENDER

*Figure 2: BeanDevice® AN-420/AN-V/AN-mV Xtender*

| Number | Function | Description |
|---|---|---|
| 1 | ***Watertight battery holder*** | DC 9-24 volts power supply<br>The socket sealing is assured with a screw cap.<br>***Don't forget to protect the M8-3contacts socket with a screw cap.*** |
| 2 | ***Radio antenna*** | 2x N-Type Radio antenna Antenna , waterproof IP67<br>***Do not try to change or modify the antenna, you will damage your BeanDevice®.*** |
| 3 | ***ON/OFF push button*** | Allows to power up/power off the BeanDevice®<br>**ON : button pushed**<br>**OFF : button not pushed**<br>***Wait for a minimum of 5 seconds before your power-up the BeanDevice®. The BeanDevice® integrates an energy tank allowing a backup of the WSN context before powering OFF.*** |
| 4 | ***BeanDevice® Activity /Failure led*** | Bi-color **GREEN** / **RED Led**<br>Cf. Table for led description |
| 5 | ***M12-5 Pins female socket for sensor interface*** | This socket is compatible with a M12-5 Pins A-Coding male plug. |
| 6 | ***BeanDevice® product version label*** | Three label version are available :<br>***AN-420*** : 4-20 mA current loop measurement<br>***AN-V*** : +/-5 volts or +/-10 volts analog measurement<br>***AN-mV*** : +/- 20 mV or +/-40 mV analog low voltage measurement |
| 7 | ***Network context push button*** | To restore default/factory parameters, you must perform a ***Network context deletion***. Push on the push-button ("Network") for more than 2 seconds. |

| | | |
|---|---|---|
| | | |
| 8 | ***Holes for wall mounting*** | The BeanDevice® is provided with a wall mounting kit. |
| 9 | ***M12 sensor cap*** | M12 sensor cap<br>***Don't forget to protect the M12 contacts socket with a screw cap. You will lose the tightness of your device if you do not close properly.*** |
| 10 | ***MAC ID Label*** | Unique identifier assigned to the BeanDevice® (64-bytes)<br>***Every wireless network product which is based on the IEEE 802.15.4 standard must have a 64-bit MAC address that allows unique identification of the device within a global network.*** |

***Recommendations:***

- ✓ ***Use only accessories supplied by BeanAir (batteries, power supply unit, and antenna). Use of other materials may damage the BeanDevice ®;***
- ✓ ***Only BeanAir is qualified to make changes on the BeanDevice®;***
- ✓ ***Don't try to remove the label on the product; it contains important information such as the MAC address or sensor measurement range***

## 6.7 LEDS DESCRIPTION

| Operating status | Led Activity Failure |
|---|---|
| The BeanDevice® is power off & external power supply is connected. | LED OFF |
| The BeanDevice® is power down with no external power supply connected | LED OFF |
| The BeanDevice® is power on with wireless TX/RX activity | Green Led: Wireless Network Activity<br>Red Led : Wireless transmission failure |
| The BeanDevice® is power on | Green led toggling |
| The BeanDevice® is power off (was power on before) | RED LED ON during 2s |

## 6.8 RF ANTENNA

### 6.8.1 Antenna diversity

Antenna diversity is a technique that maximizes the performance of an antenna system. It allows the radio to switch between two antennas that have very low correlation between their received signals. Typically, this is achieved by spacing two antennas around 0.25 wavelengths apart or by using two orthogonal polarizations. So, if a packet is transmitted and no acknowledgement is received, the radio system can switch to the other antenna for the retry, with a different probability of success.

*Figure 3: Antenna Diversity present on the BeanDevice® AN-420/AN-V/AN-mV*

### 6.8.2 Antenna specifications

| *Specifications* | | |
|---|---|---|
| ***Antenna Gain*** | 3 dBi | |
| ***Frequency*** | 2400-2485 MHz | |
| ***Bandwidth*** | 83,5 MHz | |
| ***Connector*** | N-Type (male) | |
| ***Polarisation*** | Verticale | |
| ***Nominal impedance*** | 50 Ohm | |
| ***Weight*** | 50g | |
| ***Dimensions*** | length 95 mm | |
| ***Material*** | TPEE | |
| ***Operating temperature*** | -40°C to 85°C | |

## 6.9 SENSOR INTERFACE

### 6.9.1 How to connect a sensor on your BeanDevice® ?

Several types of sensor can be plugged on your BeanDevice®:

- ✓ Current loop 4-20 mA
- ✓ Analog low voltage measurement ±20 mV
- ✓ Analog differential measurement ±10 V

Connecting a sensor is very easy but it requests to follow up several steps:

| | |
|---|---|
| ***Step 1:*** Access the configuration tab for the selected sensor channel. | •Mount the M12 Plug on your sensor . Follow the wiring code available on this document;<br>• Don't plug your sensor on your BeanDevice® AN-XX;<br>•From your BeanScape® software, click on the sensor profile associated to your BeanDevice® |
| ***Step 2***: Configure the sensor power supply | • Enter the value of your sensor power supply;<br>• A message appears on the screen, left click on "OK" to confirm. |
| ***Step 3:*** *Connect your sensor on the BeanDevice* | •Plug your sensor on your BeanDevice® AN-XX, an otch on the M12 connector allows a single way connection;<br>•Rotate the dial clockwise until fully tightened (do not overdo the rotating ring)<br>•You can start the calibration of your sensor from the BeanScape®; |

***Sensors are not provided with the BeanDevice® AN-XX series***

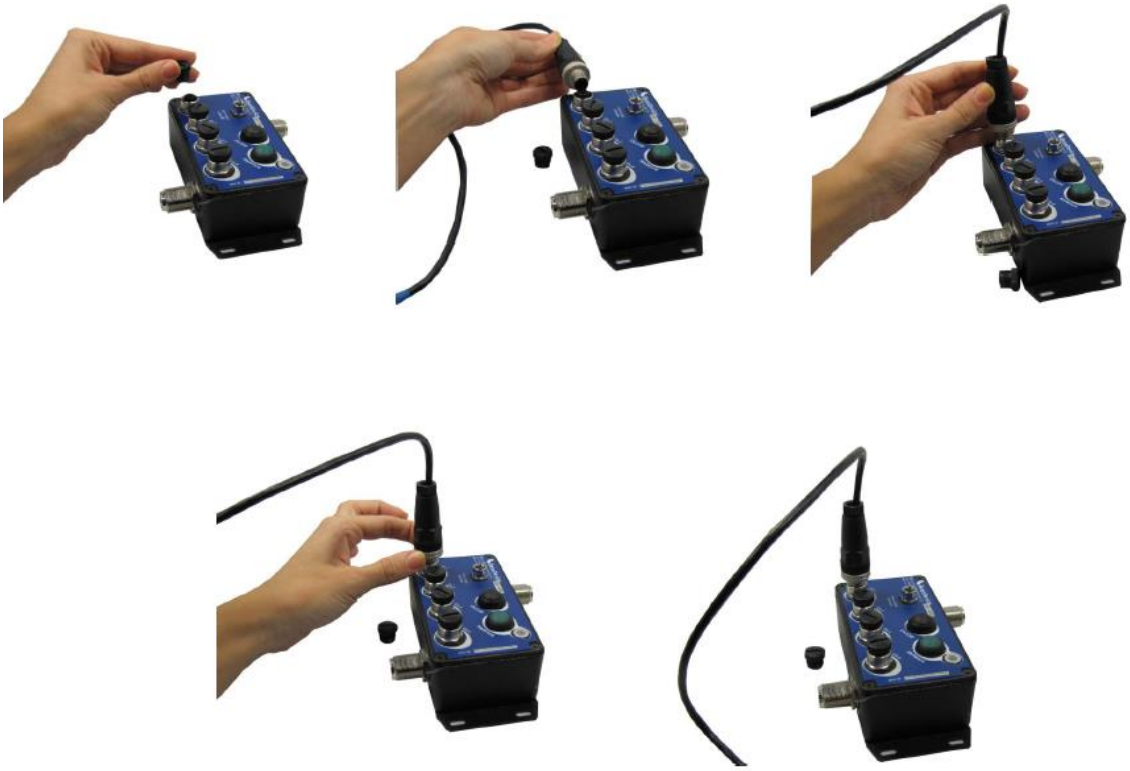


*Figure 4: Sensor connection on the Beandevice®*

### 6.9.2 Sensor power supply

The BeanDevice® AN-XX series can supply power to your external sensor. You can easily configure your sensor voltage from the BeanScape®.

The following table presents technical specifications:

| *Technical specifications* | | |
|---|---|---|
| *Voltage range* | | 4.5-20Volts DC (configurable from the BeanScape®) |
| *Voltage accuracy* | | 0.2% |
| *Maximum current delivered* | | 100 mA |
| *Maximum power delivered to the sensors* | | 1.5W |
| *Pre-process (time required to stabilize the measurement signal)* | *Max & Min during* | ***Configurable from the BeanScape® software :***<br>**10 ms minimum**<br>**10000 ms maximum** |
| | *Resolution* | 20 ms |

***Table 2:*** *External sensor power supply specifications*

In order to optimize the low consumption on the BeanDevice®, the power supply provided to the sensor operates in switching mode:

- ✓ Before performing a measurement, the sensor is powered by the BeanDevice®. The pretreatment time is fixed by the end-user, it will reflect the time needed to stabilize the measurement signal after the sensor power-up;
- ✓ When all the measurement are done, the sensor is immediately power down ;
- ✓ This cycle is repeated each time a data acquisition or a stream of data acquisition must be made;

***Example:* Sensor power supply is settled at 10 volts with 400 ms pre-process time**

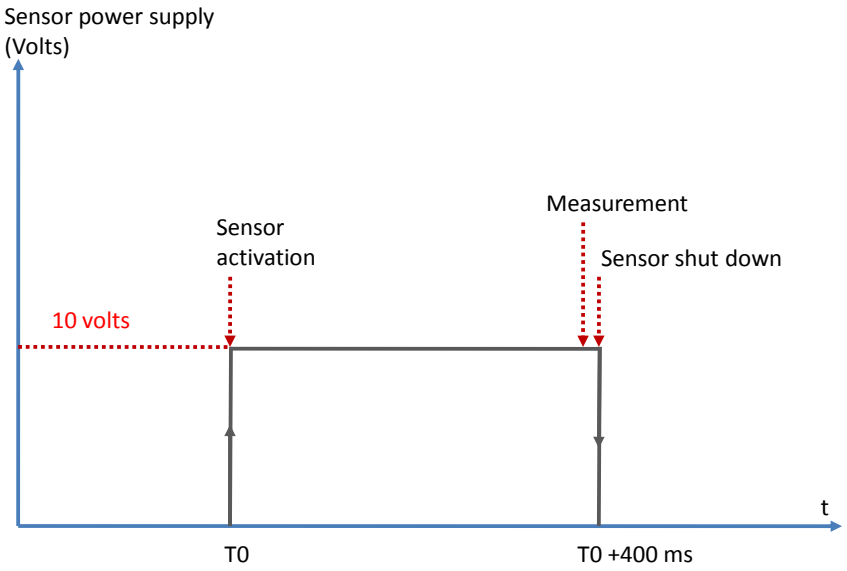



*Figure 5: Sensor power supply*

- ✓ *Choose a sensor that requires a power supply having a pre-process duration as low as possible, otherwise you will decrease the BeanDevice® battery autonomy.*
- ✓ *Some sensors require a very long pre-process duration (1-2 minutes) and some others sensors will work with a lot of current consumption. In this case we advise you to power up the sensor with an external power source.*
- ✓ *If your pre-process period is higher than your data acquisition cycle, it will be automatically adjusted by the BeanDevice®.*

***Don't forget to pre-configure the supply voltage and the pre-process duration of your sensor before connecting it. By configuring wrongly you risk to damage your sensor.***

### 6.9.3 Sensor wiring code (General overview)

*Figure 6: M12 socket location the BeanDevice®*

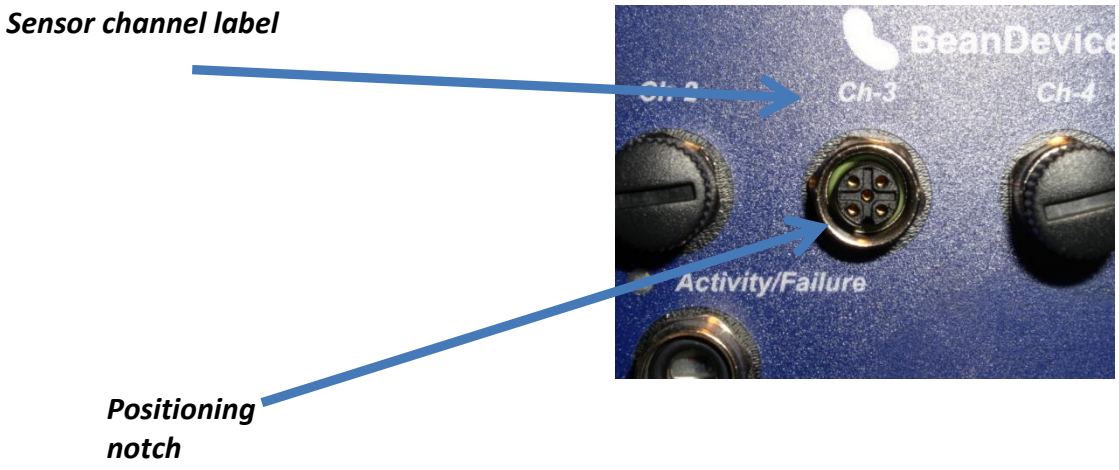



*Figure 7: M12 Socket - positioning notch*

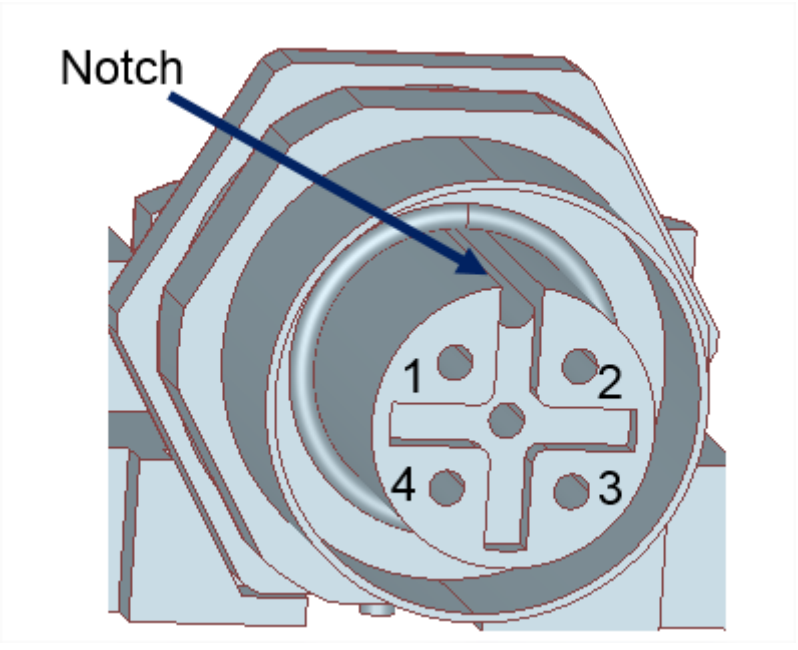
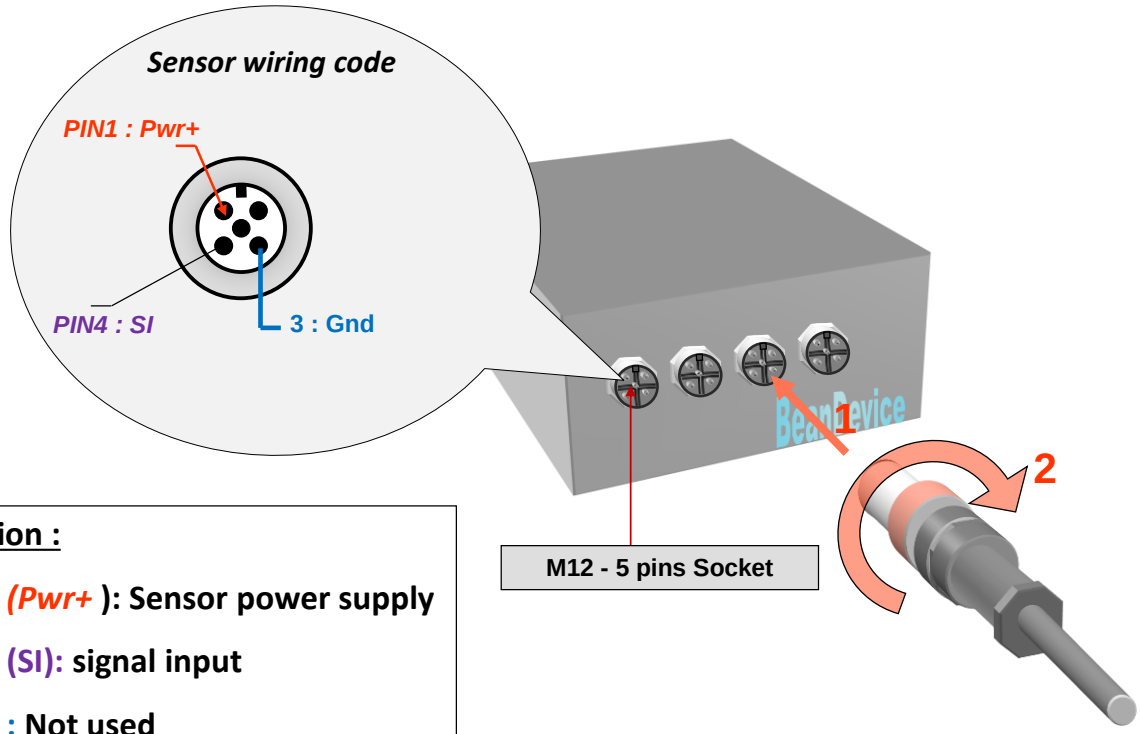



*Figure 8: M12 socket Pin assignation*

M12-4Pins A-coding should be used

### 6.9.4 Sensor wiring code (BeanDevice® AN-420)

## *M12 Socket Wiring code (BeanDevice® AN-420 side )*




**Caption :**

***PIN1 (Pwr+*** **): Sensor power supply**

**PIN4 (SI): signal input**

**PIN2 : Not used**

***PIN3 (Gnd)*****: Electrical Ground**

*Figure 9 : M12 socket Wiring Code (BeanDevice® side)*

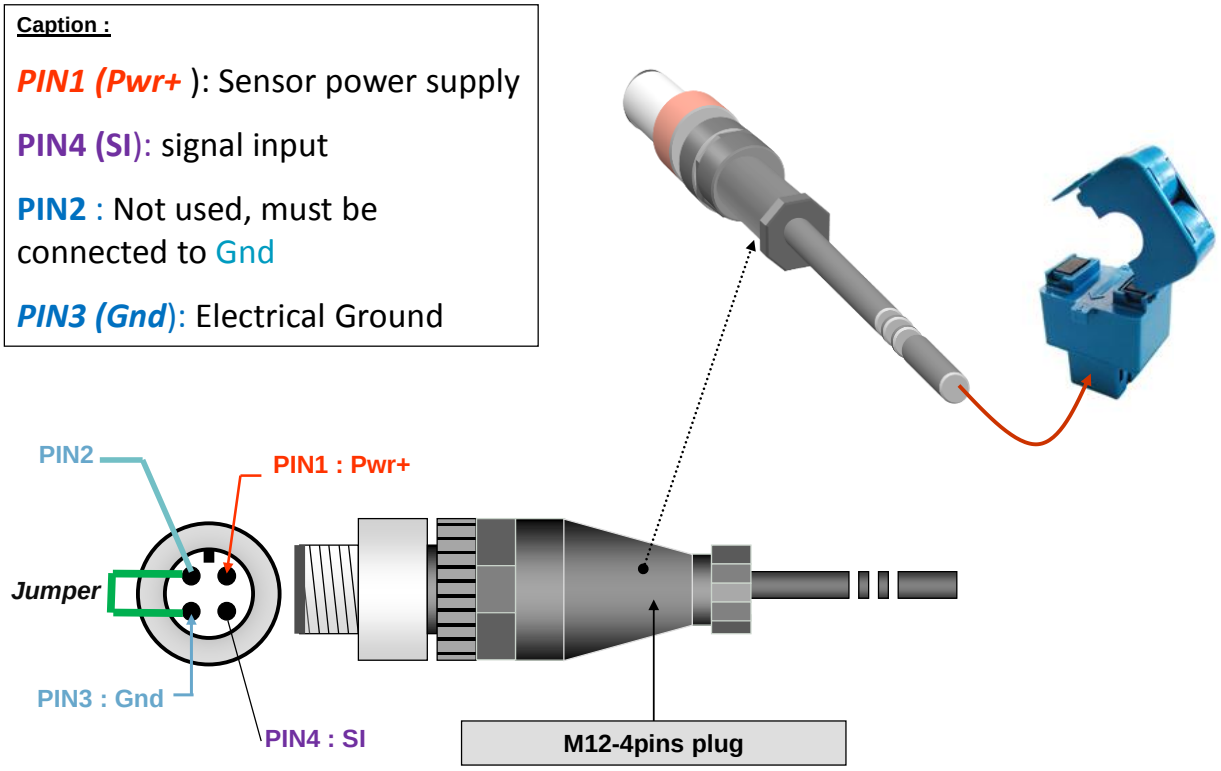


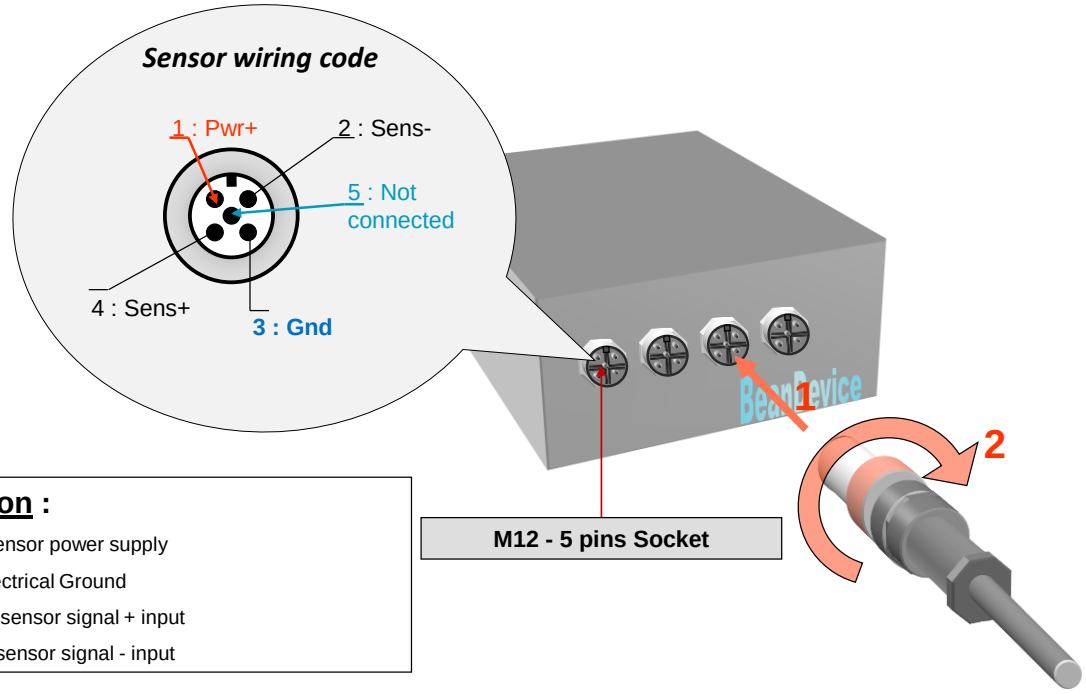

**Figure 10: M12-4pins Plug Wiring code (sensor side)**

**Instructions for connecting a 2-wire sensor:**

- ✓ Connect the sensor wire "**Loop Supply**" to ***PIN1 (Pwr+)***
- ✓ Connect the sensor wire "**Current output**" 4-20mA to ***PIN4(SI)***
- ✓ Use a jumper cable to connect **PIN3(Gnd) to PIN2**

### 6.9.5 Sensor wiring code (BeanDevice® AN-V & AN-mV)

## *M12 Socket Wiring code (BeanDevice® side )*




**Caption :**

Pwr+ : sensor power supply

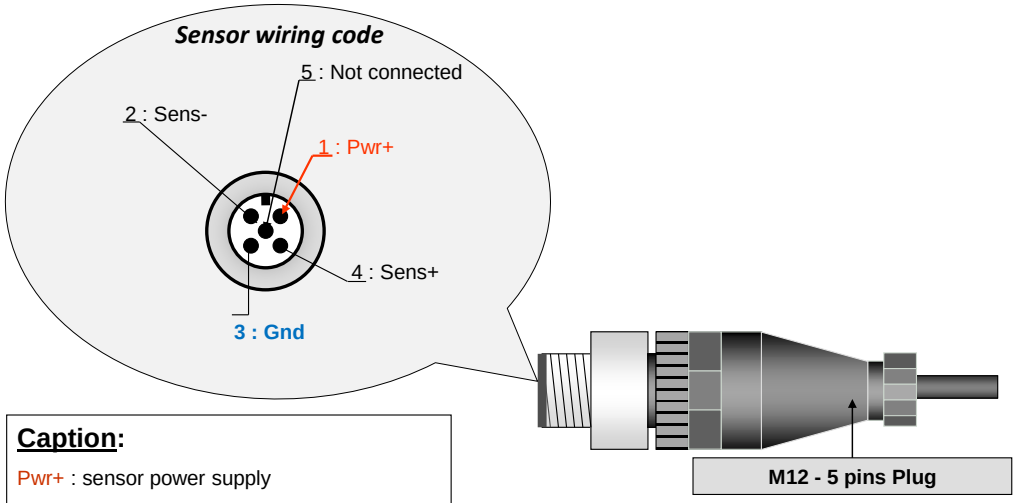
Gnd: Electrical Ground

Sens + : sensor signal + input

Sens - : sensor signal - input

## M12 Plug wiring code (sensor side)

## Sensor with analog differential output




**Caption:**

Pwr+ : sensor power supply

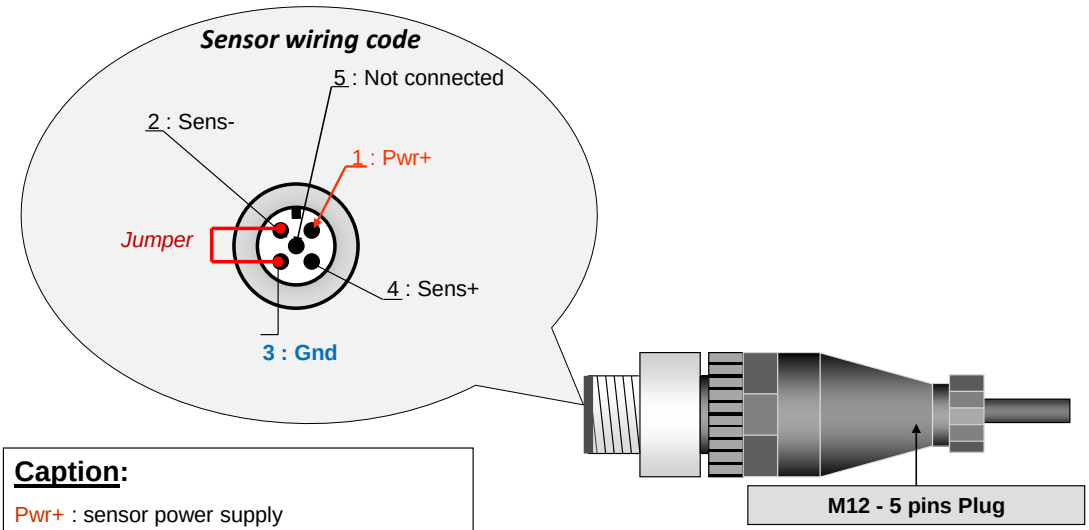
Gnd: Electrical Ground

Sens + : sensor signal + input

Sens - : sensor signal - input

## M12 Plug wiring code (sensor side)

## Sensor with unipolar analog output




**Caption:**

Pwr+ : sensor power supply

Gnd: electrical ground

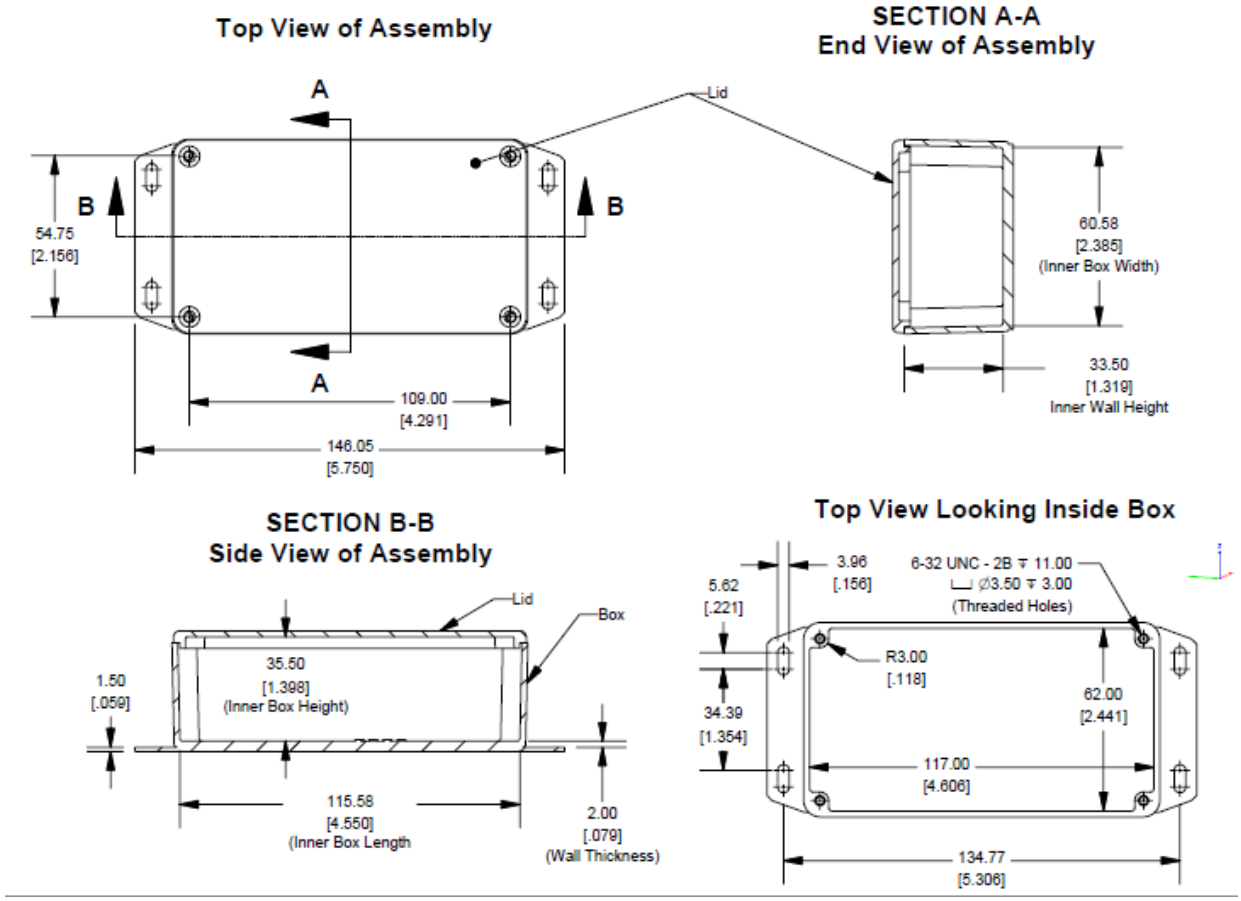
Sens + : sensor signal + input

Sens - : connected to electrical ground

✓ *If you use an unipolar analog sensor, Sens- pin must be connected to the electrical ground*

***You can damage your sensor and/or your BeanDevice® if you don't respect the wiring code.***

## 6.10 MECHANICAL DRAWING (BEANDEVICE® AN-XX)



## 6.12 BEANDEVICE® AN-XX POWER SUPPLY

### 6.12.1 Lithium-ion Rechargeable battery

The BeanDevice® from ProcessSensor product lines integrates a Lithium-Ion rechargeable battery:

| *Battery Capacity* | *Nominal Voltage* | *Charge/Discharge cycle* |
|---|---|---|
| 950 mAh | 4,2V | 300 cycles |

***The rechargeable battery can be used as an UPS (uninterruptible power supply) battery on your BeanDevice®. It provides an emergency power when the input power source, typically the utility mains, fails.***

***Do not try to change the battery. You will void the guarantee of the product.***

### 6.12.2 AC-To-DC power adapter

The BeanDevice® can also be powered by an AC-to-DC adapter ***8-28Volts***. The power adapter can be used for recharging Lithium-Ion battery or to power supply continuously the BeanDevice®.
A M8-3Pins standard plug is used for connecting the power adapter to the BeanDevice®.
If battery charge is very low, connect the power adapter in order to recharge your internal battery.

***Only the M8 plug is fully sealed, the power adapter is not sealed.***

### 6.12.3 External Power supply wiring code (not available on the BeanDevice® AN-XX Xtender)

***Caption:***

***PIN3 (Pwr+)*** : power supply 8-28 V DC

***PIN1 (Gnd)*** : electrical ground

***External power supply wiring code (M8-3Pins Socket)***

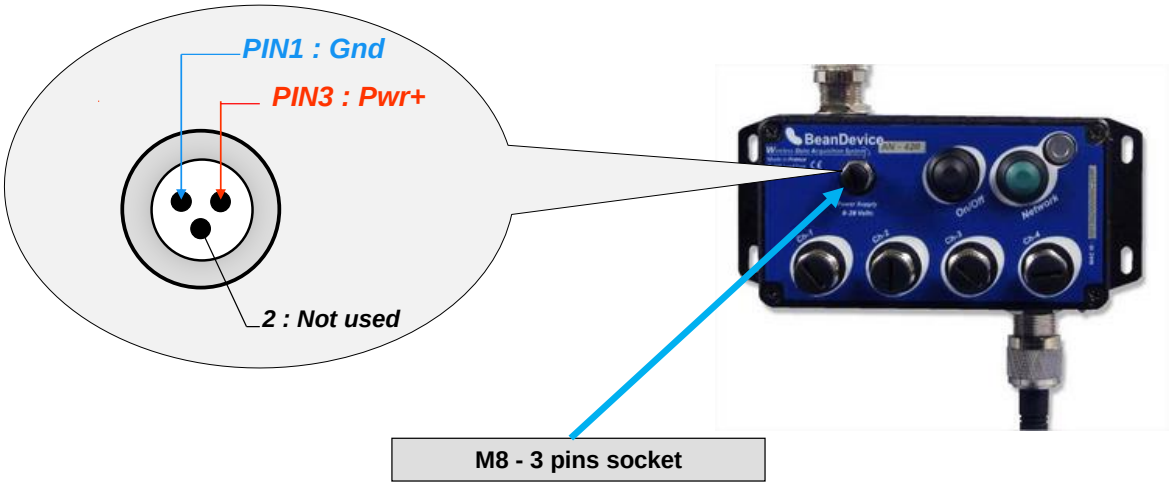



*Figure 11 : External power supply M8-3Pin - Beandevice® side*

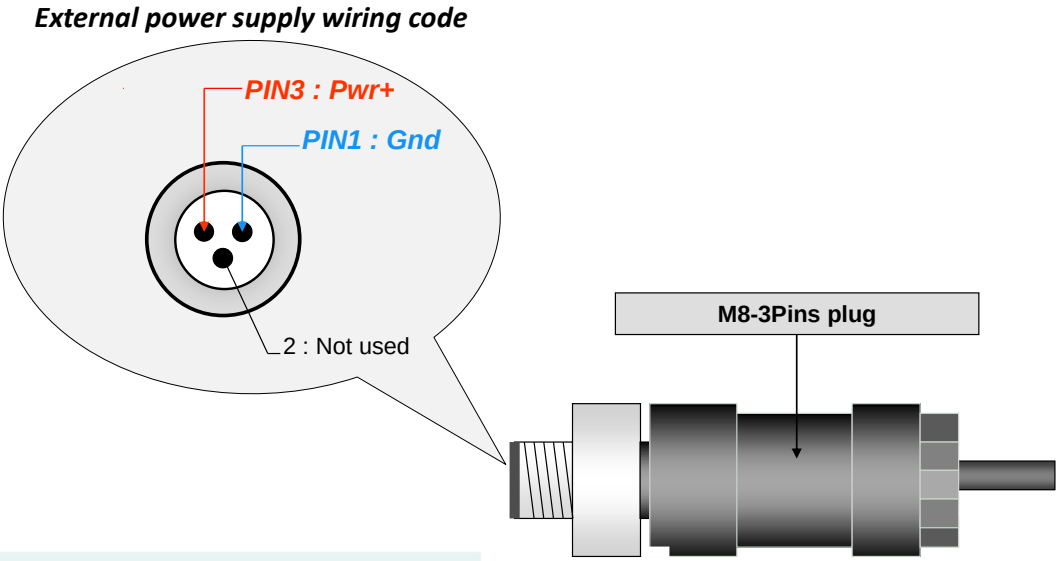



*Figure 12 : External power supply wiring code (M8-3Pin Plug side)*

## 6.13 BEANDEVICE® AN-XX EXTENDER POWER SUPPLY

### 6.13.1 Primary Cell specifications

The BeanDevice® AN-XX Xtender integrates a Primary lithium-thionyl chloride cell (***Li-SoCl2***).

| *Primary Cell Capacity* | *Size* | *Nominal Voltage* | *Operating temperature range* | *Maximum recommended continuous current* | *Pulse Capability* |
|---|---|---|---|---|---|
| *6500 mAh* | *C-size spiral cell* | *3,6 V* | *- 40°C/+ 85°C* | *1A* | *1.5 to 2A during 0.1s* |

**Table 3: Primary cell specifications table**

- ***A Prirmary Cell is not a rechargeable battery; do not try to recharge it. You will damage your primary cell and your Beandevice®***
- ***Do not use a primary cell with a Pulse Capability less than 1A. If you use an energy greedy sensor, your Beandevice® will not be able to power supply correctly the sensor.***

We recommend you the following primary cell provider:

| Provider | Model |
|---|---|
| SAFT | LSH14 |
| Europa Batteries | ER26500M |
| EVE | |
| Able Battery | |
| EEMB | |

### 6.13.2 How to change the Primary cell on the Beandevice® AN-XX Xtender

Step 1 : Open The screw cap

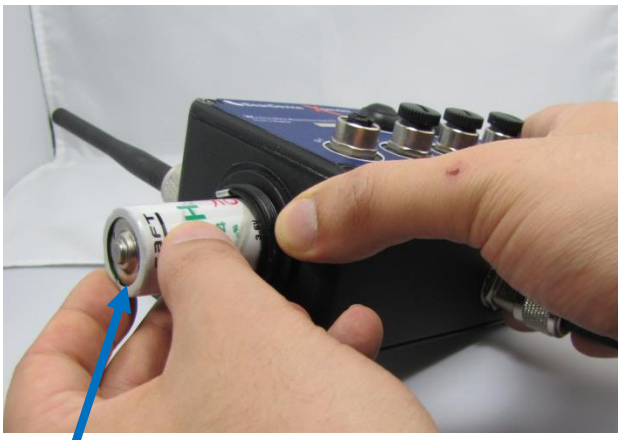
- ***Open the screw cap***
- ***The primary cell is inside the battery holder***

Step 2 : Change the primary Cell

- ***Change the primary cell***
- ***Check the battery polarity: pole + is on the screw cap side;***

***Gasket***

***Pole +***

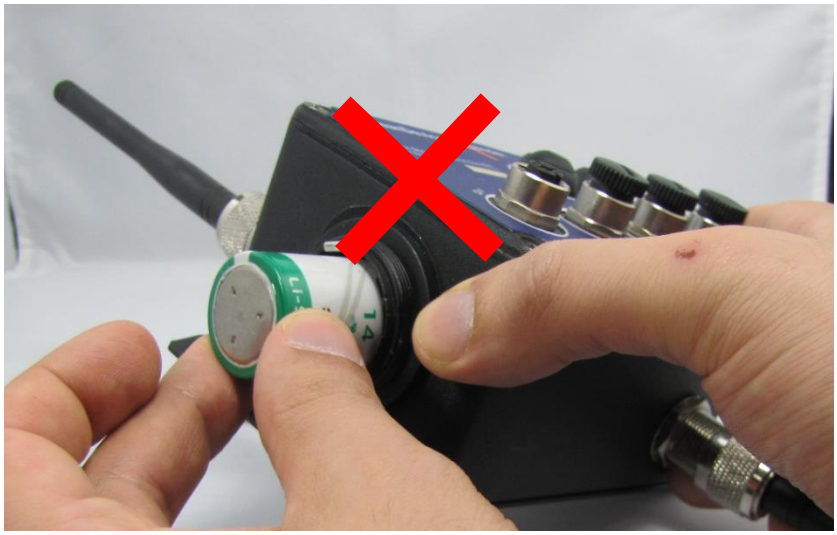


***Pole +***

Step 2 : Close the screw cap

- ***Close properly the screw cap***
- ***Don't forget the Gasket, otherwise you will loose the Beandevice sealing ;***

***Do not invert the battery polarity, your BeanDevice® will not work.***



# 7. DATA ACQUISITION MODE DESCRIPTION

***Please read the technical note TN_RF_008 – "Data acquisition modes available on the BeanDevice®"***

# 8. BEANDEVICE® PROCESSSENSOR INSTALLATION GUIDELINES

## 8.1 POWER MODE MANAGEMENT

*Please read the technical note TN_RF_010 – « BeanDevice® Power Management »*

## 8.2 BEANDEVICE® NETWORK ASSOCIATION

*Please read the technical note TN_RF_006 – "WSN Association process"*

## 8.3 DATALOGGER FUNCTION

*Please read the technical note TN_RF_007 – "BeanDevice® DataLogger User Guide "*

## 8.4 OTAC (OVER-THE-AIR-CONFIGURATION) PROCESS

*Please read the technical note TN_RF_010 – « BeanDevice® Power Management »*

## 8.5 FACTORY SETTINGS

If desired, the user can restore factory settings on the Beandevice® with the following default parameters:

| Parameter | BeanDevice® version | | |
|---|---|---|---|
| | AN-420 | AN-V | AN-mV |
| Power Mode | Active | Active | Active |
| Data Acquisition duty cycle | 10s | 10s | 10s |
| Acquisition duration time | OK | OK | OK |
| Sampling rate | OK | OK | OK |
| Data Acquisition mode | LowDutyCycle | LowDutyCycle | LowDutyCycle |
| TX Power | +18dBm | +18dBm | +18dBm |
| Alarms Threshold | H1 :20<br>H2 :20<br>S2 :4<br>S1 :4 | H1 :10<br>H2 :10<br>S2 :0<br>S1 :0 | H1 :20<br>H2 :20<br>S2 :0<br>S1 :0 |
| Pre-process duration time | 30 ms | 30 ms | 30 ms |
| Sensor polarity | N.A. | Unipolar | Unipolar |

*Table 4: Factory settings*

To restore these defaults parameters, you must perform a ***Network context deletion***. Push on the push-button ("Network") for more than 2 seconds.

***If you fix the TX power at its minimum value (-7dBm), and the wireless range is more than 5m, you will lose the radio signal. To find a configuration with a maximum RF: by pressing the Network Context button, you can reset to factory settings (default RF power is fixed at its maximum: 18 dBm)***

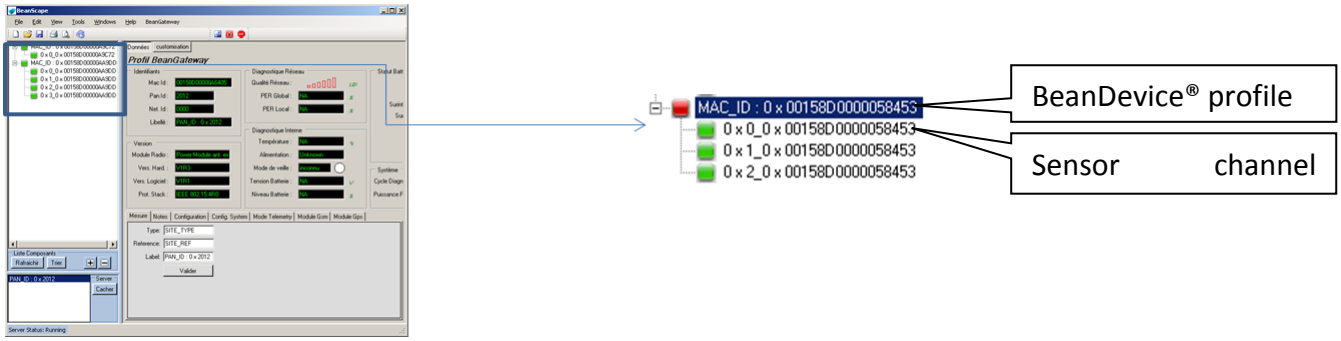
# 9. BEANDEVICE® SUPERVISION FROM THE BEANSCAPE

***Don't hesitate to read the BeanScape® user manual for further informations about the BeanScape®***

## 9.1 STARTING THE BEANSCAPE®

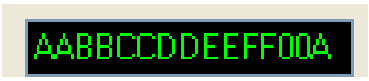
BeanScape® is a supervision software monitor fully dedicated to BeanAir WSN (Wireless Sensor Networks):

1. ***Start the BeanScape® by double-clicking on the BeanScape®***
2. ***Click on the button « start »***
3. ***All the BeanDevice® connected to the WSN will appear on your left window***
4. ***Select the BeanDevice® you want to configure. You can configure your BeanDevice® and its attached sensors.***

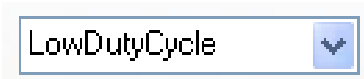



***The User interface is organized as follow***:

- Green on black background are displaying information

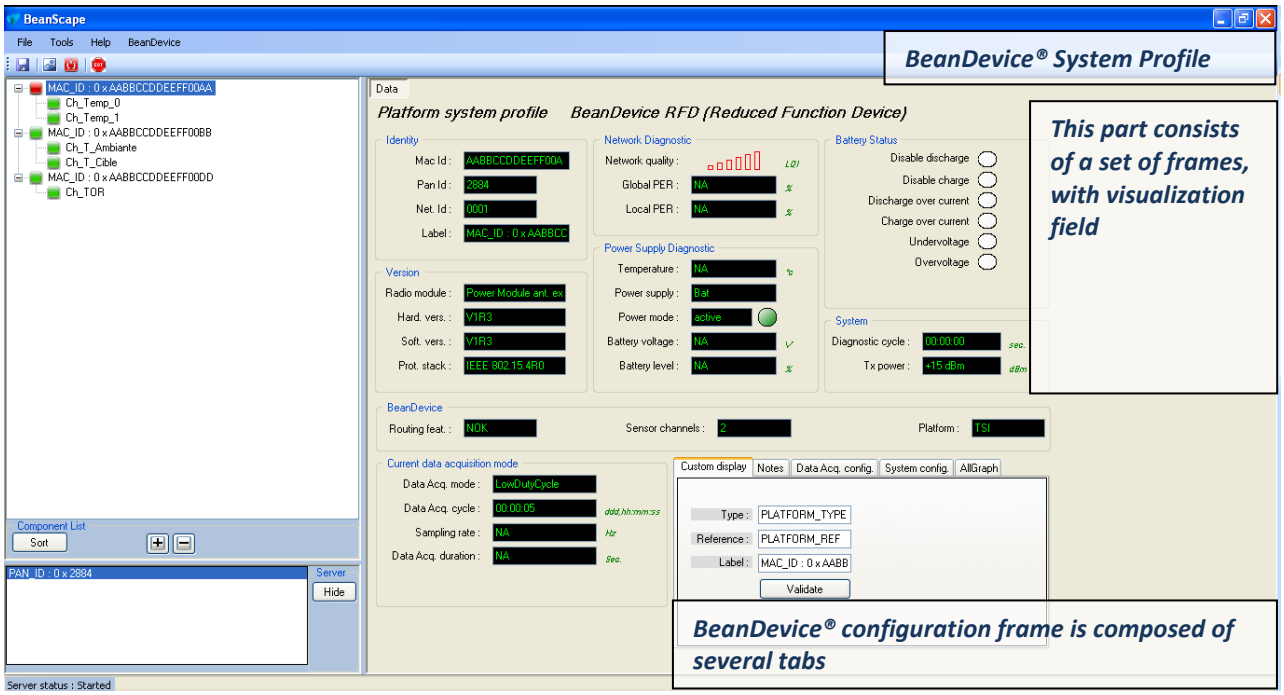



- Black on white background are customizable field;



You can configure your BeanDevice® from the page "***BeanDevice® System Profile***". This page is composed of two parts:

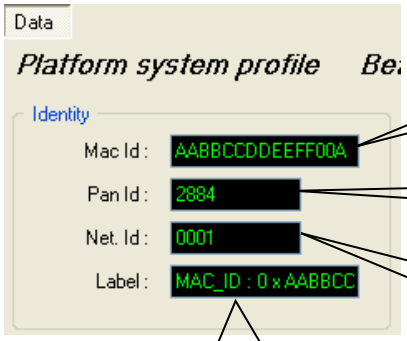
- ✓ BeanDevice® information display;
- ✓ BeanDevice® configuration;


BeanScape
File Tools Help BeanDevice
BeanDevice® System Profile
Platform system profile
BeanDevice RFD (Reduced Function Device)
This part consists of a set of frames, with visualization field
BeanDevice® configuration frame is composed of several tabs
Server status : Started

## 9.2 DISPLAYING THE BEANDEVICE® INFORMATIONS

You will find below a description of the data information fields making up for each frame.

### 9.2.1 Frame: Identity




**MAC Address (encoded on 64-bits):** The Media Access Control address is a unique identifier assigned

***PAN Address (encoded on 16-bits):*** Personal Area

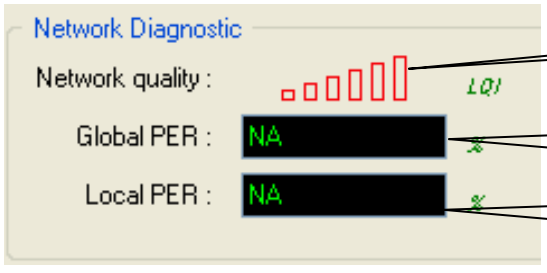
***Network Address on 16-bits***: This address is allocated by the

***BeanDevice® Label***: By default the MAC address is Registered as a Label. This label can be changed by the user.

***How PAN ID is assigned ?***

***The BeanGateway® starts the WSN, assigning a PAN ID (Personal Area Network identifier) to the network. The PAN ID is pre-determined and cannot be modified. If you use several WSN, before deploying your BeanDevice® check to which WSN is assigned your BeanDevice®.***

### 9.2.2 Frame : Wireless Network Diagnostic




Link quality indicator of the BeanDevice® (0 to 255)

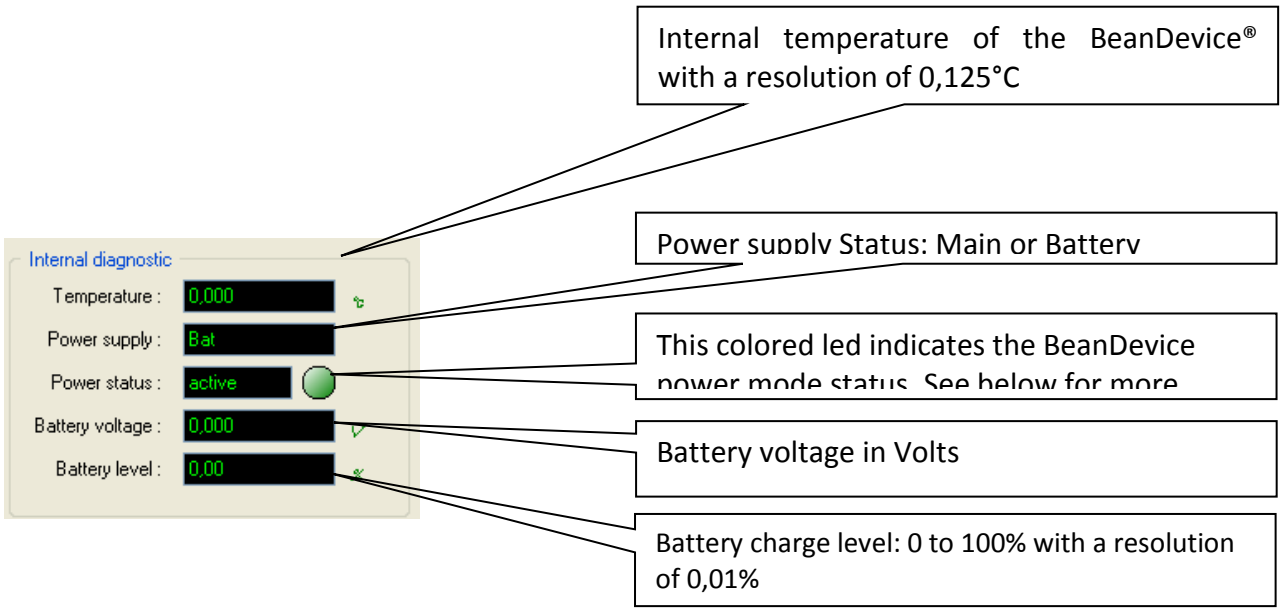
***Global Packet error rate (PER)*** : represents the PER on a

***Local Packet error rate (PER):*** represents the PER between parent and child nodes.

*PER = Number of lost packet/Total of packet transmitted*

| Number of bars | Color | Link quality indicator |
|---|---|---|
| 5 to 6 bars | Green | Very good |
| 4 bars | Green | Good |
| 3 bars | Orange | medium |
| 1 to 2 bars | Red | bad |

### 9.2.3 Frame : Internal diagnostic


Internal temperature of the BeanDevice® with a resolution of 0,125°C
Power supply Status: Main or Battery
This colored led indicates the BeanDevice power mode status. See below for more
Battery voltage in Volts
Battery charge level: 0 to 100% with a resolution of 0,01%
Internal diagnostic
Temperature : 0,000
Power supply : Bat
Power status : active
Battery voltage : 0,000
Battery level : 0,00

***The BeanDevice® incorporates an internal temperature sensor dedicated to the following tasks:***

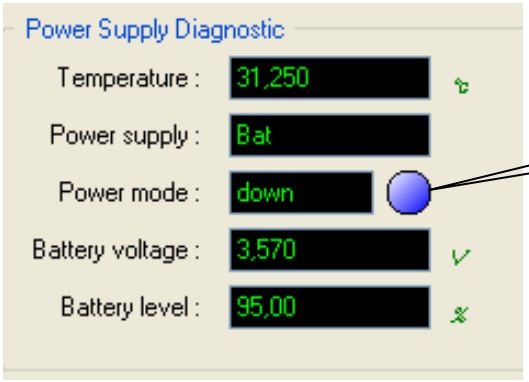
- ***Battery temperature monitoring during charging ;***
- ***Temperature compensation of the analog conditioning chain ;***
- ***An alarm notification is send to the BeanGaeway® if the internal temperature is anormally high ;***

***When you plug the BeanDevice® on an external power supply, the power supply status is automatically detected.***

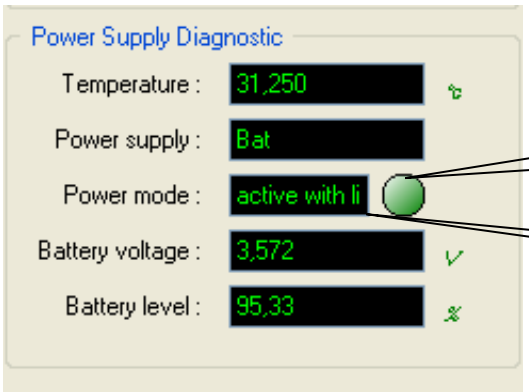
***If your primary cell charge level is under 5%, it is highly recommended to recharge your battery. Your BeanDevice® from SmartSensor product lines integrates a battery charger.***

9.2.3.1 BeanDevice® Power Mode status

***For further information about Power mode management, please read the technical note TN_RF_010: "BeanDevice® Power management"***

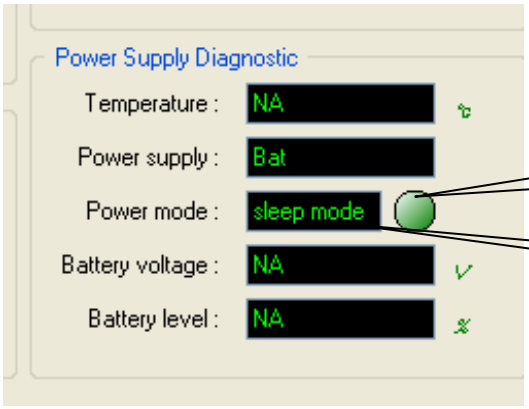



**BLUE LED:** The BeanDevice® is power off



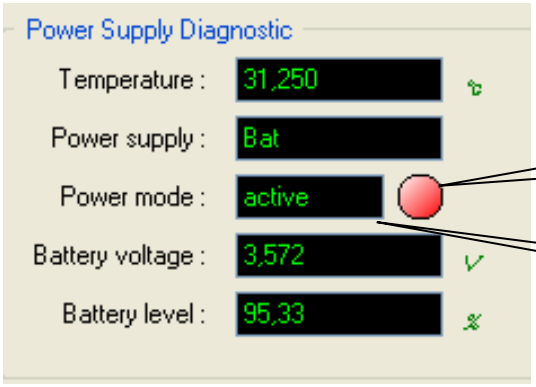

**GREEN LED:** The BeanDevice® is in sleeping with network Listening power mode

Sleeping with network listening power mode is displayed




**GREEN LED:** The BeanDevice® is in active sleeping power mode

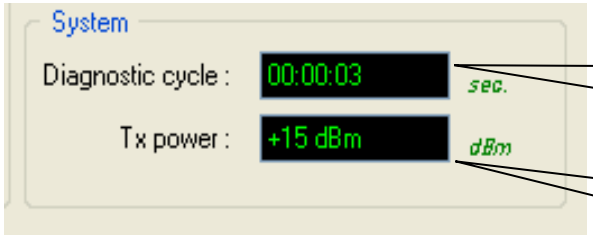
Sleeping power mode is displayed




**RED or YELLOW LED:** The BeanDevice® is in active power mode

Active mode is displayed

### 9.2.4 Frame : System




**Displays diagostic Cycle in seconds (battery charge status,**

**Displays Radio TX Power in dBm (antenna power is not included)**

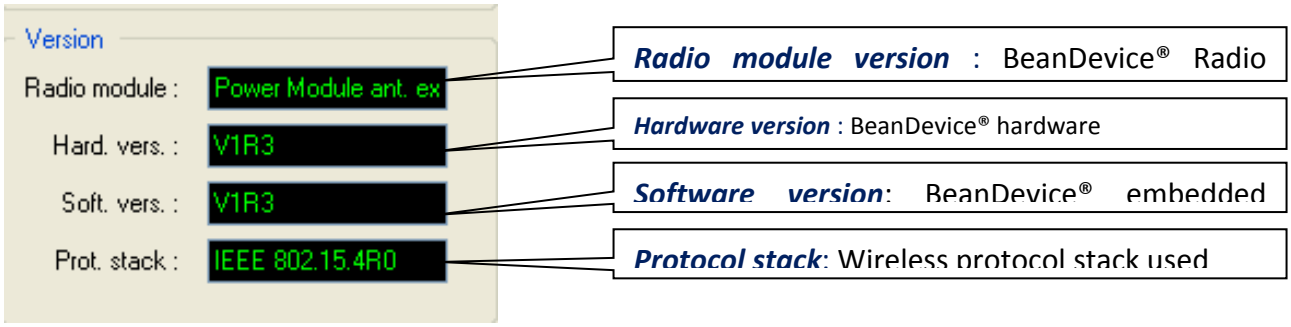
### 9.2.5 Frame : BeanDevice®

According to the BeanDevice® version, the information displayed in the frame will not be the same. For example, for the BeanDevice® TSI:

| *NOK* : Routing capacity not available<br>*OK* : Routing capacity available | Number of sensors channels available on the BeanDevice®. | BeanDevice® Platform |
|---|---|---|

*Routing capacity is not available on IEEE 802.15.4 protocol stack*

### 9.2.6 Frame : Product Version



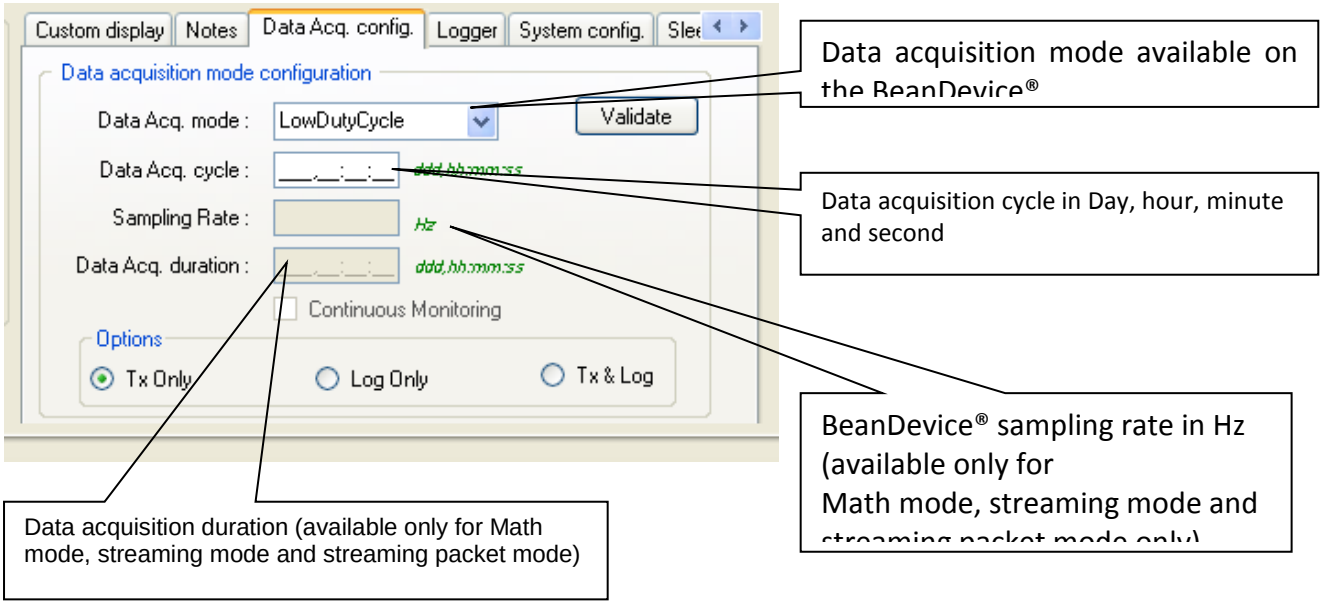

***V (version)*** related to a major modification of the embedded software.

***R (Release)*** related to a minor modification of the embedded software

***These ID versions should be transmitted to our technical support center when you encountered a material or software dysfunction.***

### 9.2.7 Frame : Actual Data Acquisition mode

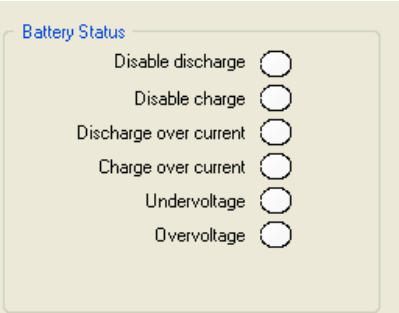
This frame displays all the informations returned by the BeanDevice® on its actual data acquisition mode:


Custom display
Notes
Data Acq. config.
Logger
System config.
Data acquisition mode configuration
Data Acq. mode :
LowDutyCycle
Validate
Data Acq. cycle :
Sampling Rate :
Hz
Data Acq. duration :
Continuous Monitoring
Options
Tx Only
Log Only
Tx & Log
Data acquisition mode available on the BeanDevice®
Data acquisition cycle in Day, hour, minute and second
BeanDevice® sampling rate in Hz (available only for Math mode, streaming mode and streaming packet mode only)
Data acquisition duration (available only for Math mode, streaming mode and streaming packet mode)

### 9.2.8 Frame : Battery/Primary Cell status

In this frame, information on battery/primary cell status is displayed.

The BeanDevice® performs frequently a battery diagnostic on the BeanDevice®. An alarm notification is transmitted automatically to the BeanScape® if a battery failure is detected on the BeanDevice®.



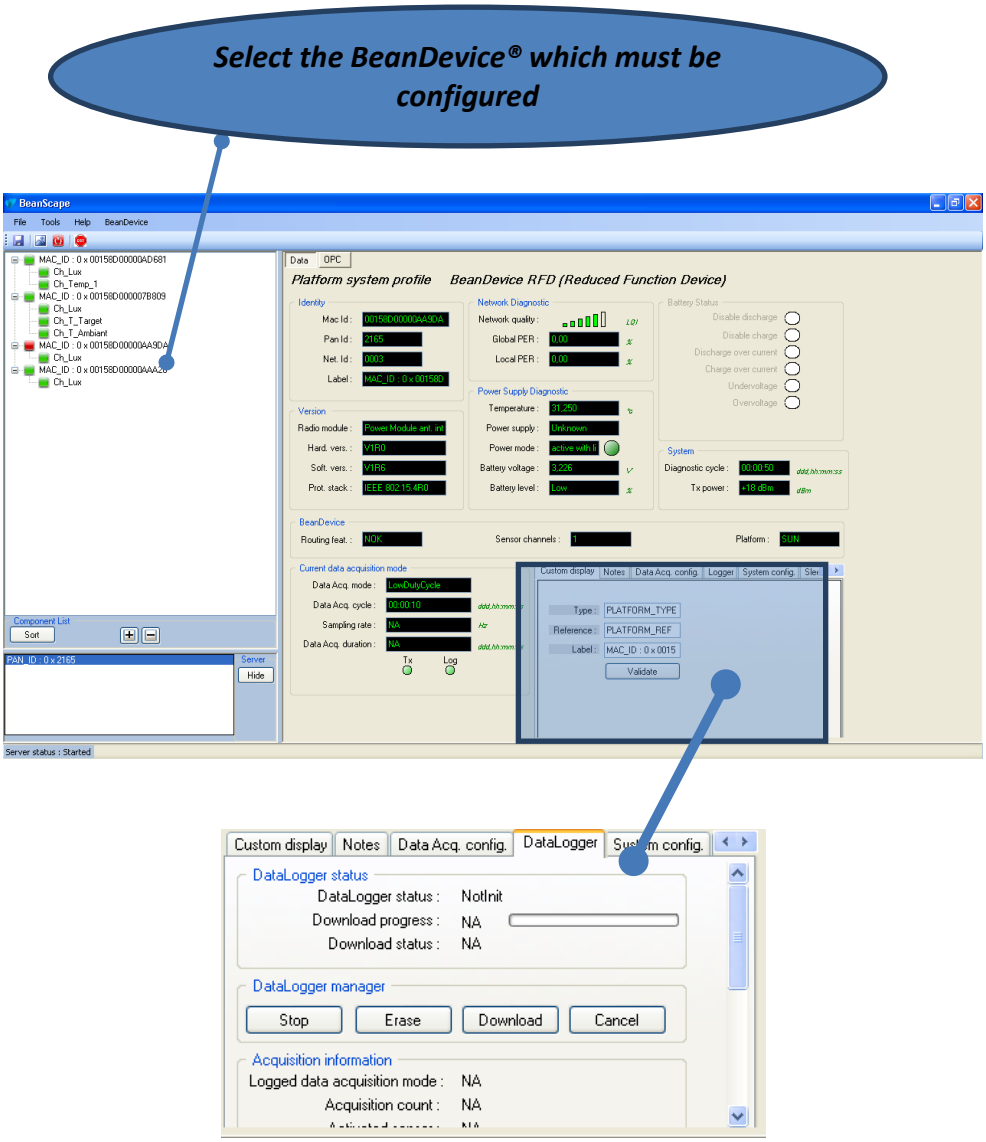

If any battery status information is displayed (ex: the BeanDevice® is not connected), status led is white.

When LEDS are green a normal state is indicated. During a malfunction, the LEDS turns red.

Here are the details:

| Led definition | Green Led signification | Red led signification |
|---|---|---|
| Disable Discharge | Battery discharge activated | Battery discharge deactivated |
| Disable Charge | Battery charge activated | Battery charge deactivated |
| Over current during battery discharge | No over current during battery discharge | Over current during battery discharge detected |
| Over current during battery charge | No over current during battery charge | Over current during battery charge detected |
| Overvoltage | Any presence of battery overvoltage | Battery over voltage detected on the battery |
| Under voltage | Any presence of battery under voltage | Battery under voltage detected on the battery |

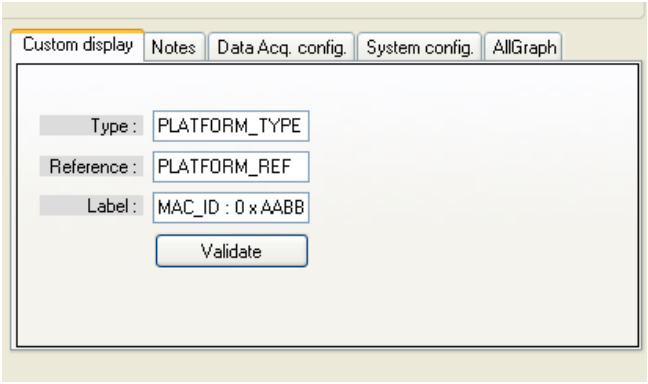
## 9.3 BEANDEVICE® CONFIGURATION



This frame is composed of several Tabs and includes BeanDevice® OTAC (Over the Air Configuration) Parameters:

- ✓ ***Custom display***
- ✓ ***Notes***
- ✓ ***Data acquisition configuration***
- ✓ ***DataLogger***
- ✓ ***System configuration***
- ✓ ***Power Mode management***
- ✓ ***AllGraph***

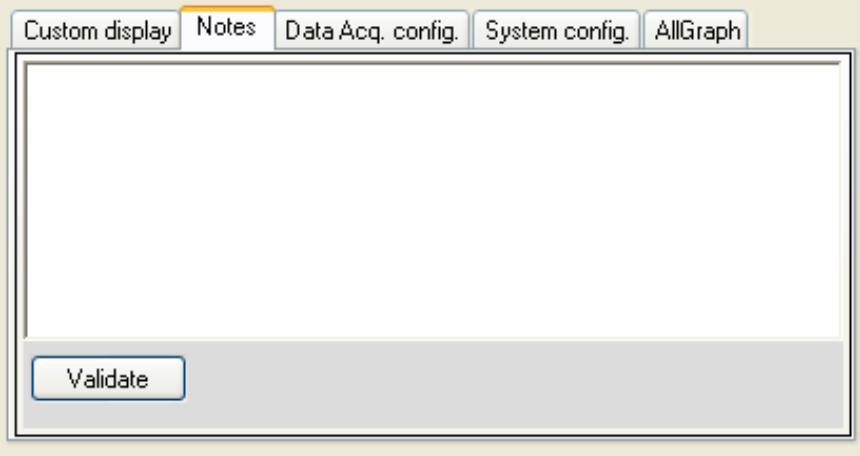
### 9.3.1 Tab: Custom Display




| Parameter | Description |
|---|---|
| ***Type*** | You can enter here the type of BeanDevice® you want to use |
| ***Reference*** | You can assign an internal reference to the BeanDevice® you have purchased. |
| ***Label*** | You can assign any sort of Label to your BeanDevice®. Therefore, the user can easily associate the BeanDevice® with its equipment (example: Room_N521_Second_Floor) |

Click on "***Validate***" if you want to validate your configuration.

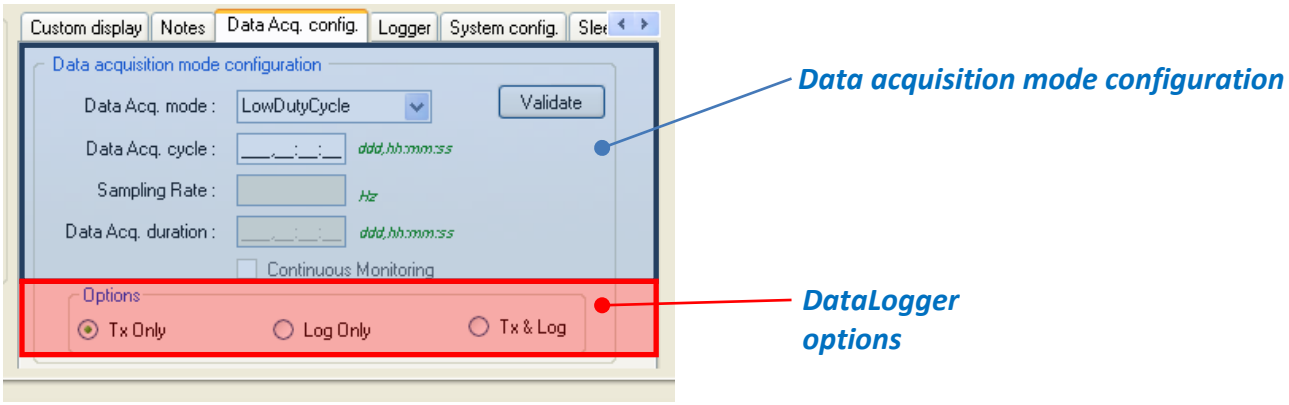
### 9.3.2 Tab: Notes




This field contains your notes concerning the BeanDevice®. To change this field, enter your text and click on « ***Validate*** » button. To backup your text, press the icon

***Example***: Machine failure n°XX, requested intervention.

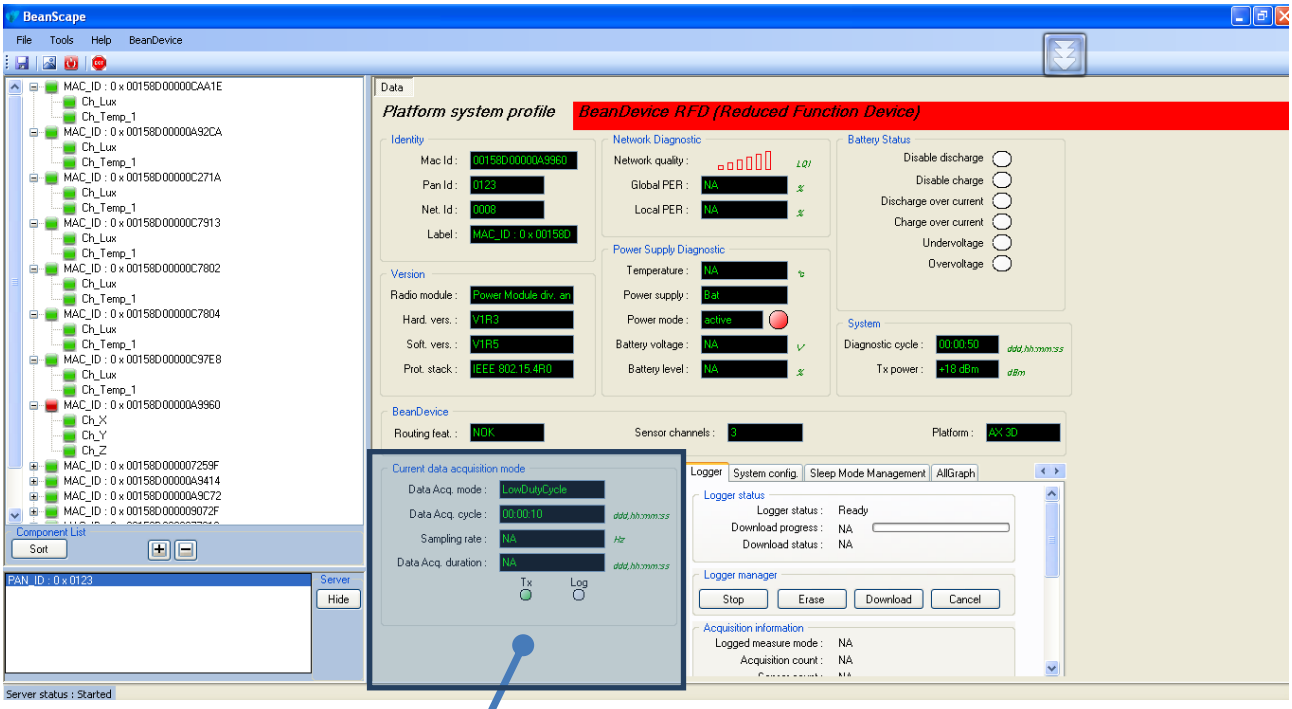
### 9.3.3 Tab : Data Acquisition configuration

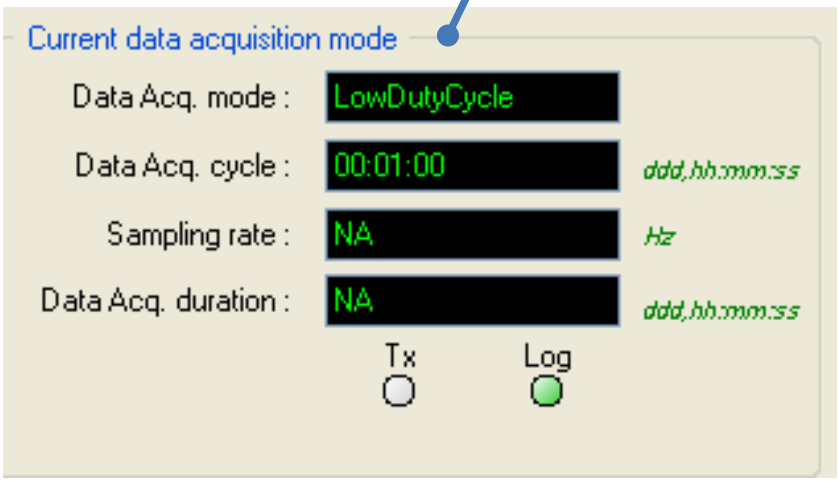



| Parameter | Different values | Description |
|---|---|---|
| Data Acquisition mode | ***Low duty cycle Data Acquisition (LDCDA)*** | Low duty cycle data acquisition is adapted for static measurement (tilt, pressure, temperature) requiring a low power consumption on your BeanDevice®. The duty cycle can be configured between 1 data acquisition & transmission per second to 1 data acquisition & transmission per day. |
| | ***Alarm*** | Data acquisitions are transmitted by radio whenever an alarm threshold (fixed by the user) is reached (4 alarms threshold levels High/Low). |
| | ***Survey*** | Survey mode is a mix between the LDCDA mode and Alarm mode. A data acquisition is transmitted<br>▪ Whenever an alarm threshold (fixed by the user) is reached (4 alarm threshold levels High/Low).<br>▪ A transmission cycle is reached, the transmission cycle is configurable through the BeanScape® 1s to 24h ; |
| | ***Streaming Packet*** | Streaming packet is more suitable for users requiring a high data sampling rate (maximum 5 KHz). In order to achieve these performances, data sampling are transmitted by packet; |
| | ***Streaming*** | Streaming mode is more suitable for users requiring a real-time data transmission (with time latency under 10ms). |

| | |
|---|---|
| Data acquisition Cycle | Select the Data acquisition cycle between 1s and 24hours.<br>The format is: Day : Hour : Minute :Second |
| Sampling rate | Select the sampling rate of your BeanDevice® between 1 sample per second and 5000 Samples per second maximum. The resolution is 1 sample per second.<br>If DataLogger is selected, the maximum sampling rate is 2000 samples per second.<br>This field is available in streaming, streaming packet, and math mode<br>Choose carefully the Sampling rate value:<br>✓ The PER (Packet Error Rate) can increase if the Sampling rate is high on your BeanDevice®. For further information read the technical note ***RF_TN_003 V1.0-"Wireless Network capacity"***<br>✓ Power consumption increases with the sampling rate of your BeanDevice® |
| Data acquisition duration | Data acquisition duration in streaming, streaming packet, and math mode.<br>The format is Day : Hour : Minute :Second<br>The Data acquisition duration value can be higher than Data acquisition cycle. |
| Options | ***Tx only***: The BeanDevice® transmits the data acquisition without Datalogging<br>***Log only***: The Beandevice® logs the data acquisition without wireless transmission<br>***Tx & Log***: The BeanDevice® transmits and logs the data acquisition;<br>For further information about the DataLogger feature, read the technical note TN_RF_007 – "BeanDevice® DataLogger User Guide " |

All your modifications are displayed on "***Current data acquisition mode***" frame:

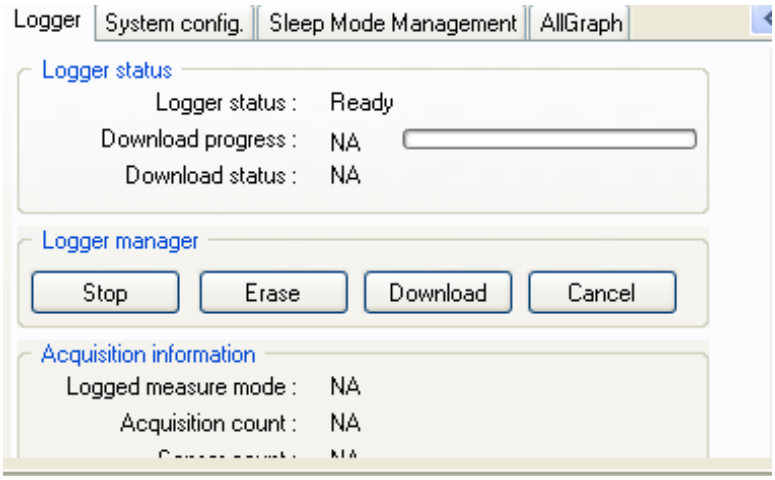



***For further information, please read to the technical note TN_RF_008 – "Data acquisition modes available on the BeanDevice®"***

### 9.3.4 Tab: DataLogger

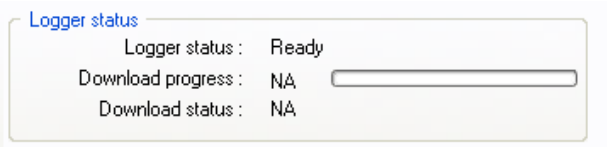
***For further information about Datalogger, please read the technical note TN_RF_007 : "BeanDevice® DataLogger User Guide®".***




The Logger tag is composed of five different fields:

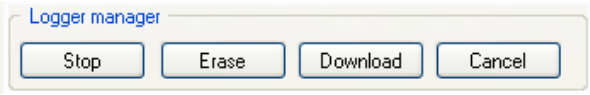
- ***Logger Status***
- ***Logger manager***
- ***Acquisition information***
- ***Logger memory configuration***
- ***Logger status***

#### 9.3.4.1 Logger status



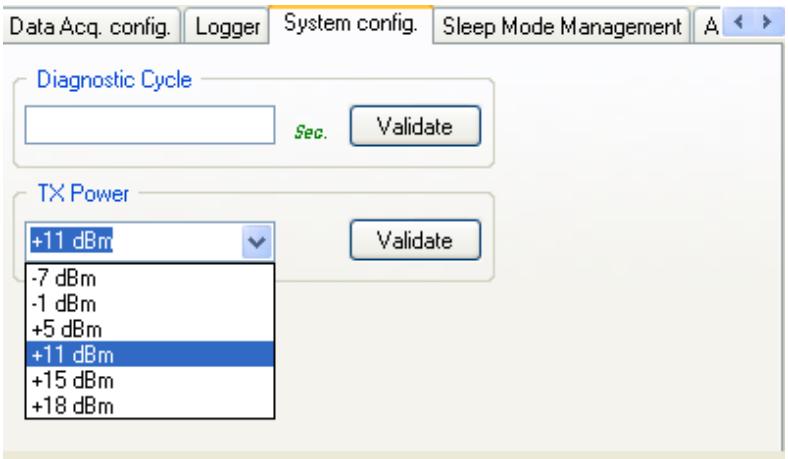
- ***Logger status***: Displays loggers status, four status are available:
  - ***Ready***: the Datalogger is ready to register data
  - ***NotInit***: the Datalogger is not initialized;
  - ***Active logs only***: Data acquisition is logged only;
  - ***Active Tx and Log***: Data acquisition is logged & transmitted by Radio;
  - ***Stopped***: Datalogger is stopped;
- ***Download process***: Displays the download process 0 to 100%. If 100%, all the data logs are successfully downloaded on your PC.
- ***Donwload status***: Displays the download status , two types of status are available:
  - ***Processing***: Data logs download is under process;
  - ***Completed:*** Data Logs are completely downloaded on your PC;

#### 9.3.4.2 Logger manager



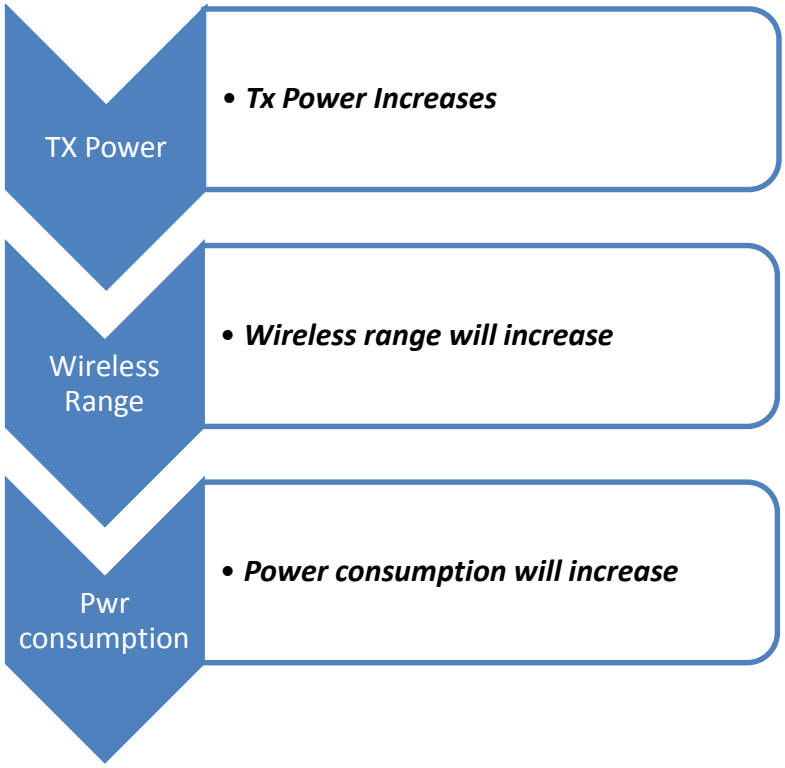

- ***Stop***: Stops Data Logging process
- ***Erase***: Stops & Erases all the logs on flash memory
- ***Download***: Starts to download all the logs on the flash memory
- ***Cancel***: Stops the download process

### 9.3.5 Tab : System config.



| *Parameter* | *Description* |
|---|---|
| ***Diagnostic cycle*** | You can set the BeanDevice® diagnostic cycle (Battery status, LQI, PER ...). The Diagnostic cycle is modulo the data acquisition cycle.<br>***Ex***: If you try to set the diagnostic cycle at 10s while the data acquisition cycle is set at 20s, the diagnostic cycle will be adjusted to 10s ; |
| ***TX Power*** | BeanDevice® TX Power unit is in dBm, it represents the power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW). The antenna radio power is not included. If the BeanDevice® PER is high or the LQI is too low, try to increase the transmission power. |

***The following flow chart shows the effect of a higher TX power:***




***If you fix the TX power at its minimum value (-7dBm), and the wireless range is more than 5m, you will lose the radio signal. To find a configuration with a maximum RF: by pressing the Network Context button, you can reset to factory settings (default RF power is fixed at its maximum: 18 dBm)***

***Some recommendations:***

- ***If you fix the TX power at its minimum value (-7dBm): you will lose the radio link between your BeanGateway® and the BeanDevice®, if the wireless range is more than 5m,***
- ***By pressing the Network push button for more than 2s, you can reset to factory settings (default RF power is fixed at its maximum: 18 dBm).***

***How to convert dBm to mW***

***Zero dBm equals one milliwatt. A 3dB increase represents roughly doubling the power, which means that 3 dBm equals roughly 2 mW. For a 3 dB decrease, the power is reduced by about one half, making –3 dBm equal to about 0.5 milliwatt. To express an arbitrary power P as x dBm, or go in the other direction, the following equations may be used:***

$$x = 10\log_{10}(1000P) \text{ or, } x = 10\log_{10}P + 30$$

***and***

$$P = 10^{(x/10)}/1000 \text{ or, } P = 10^{(x-30)/10}$$

***where P is the power in W and x is the power ratio in dBm.***

***Inside a building, the maximum authorized power is +12 dBm (antenna power included). It is highly recommended to follow the R&TTE guidelines. For more information please visit http://www.etsi.org. It is your responsibility to carefully observe the R&TTE guidelines.***

### 9.3.6 Tab : Power mode management

***For further information about Power mode management, please read the technical note TN_RF_010: "BeanDevice® Power management"***

This Tab is composed of three frames:

- ✓ ***Sleep mode configuration:*** Configure the Power mode on your BeanDevice®
- ✓ ***Listening Mode Status :*** Describes the status of an OTAC (Over-the-air-Configuration)
- ✓ ***Sleep mode with listening config. :*** Configuration settings for Sleep mode with network listening

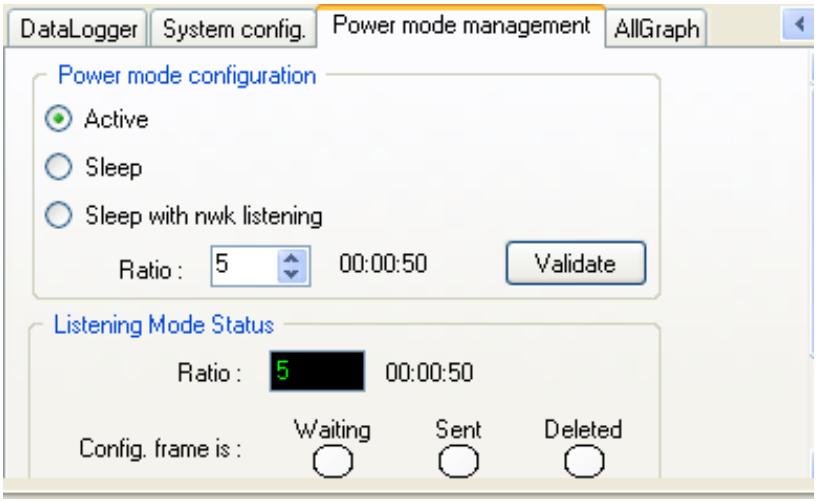



***Figure 13 : Power mode management -First frame***

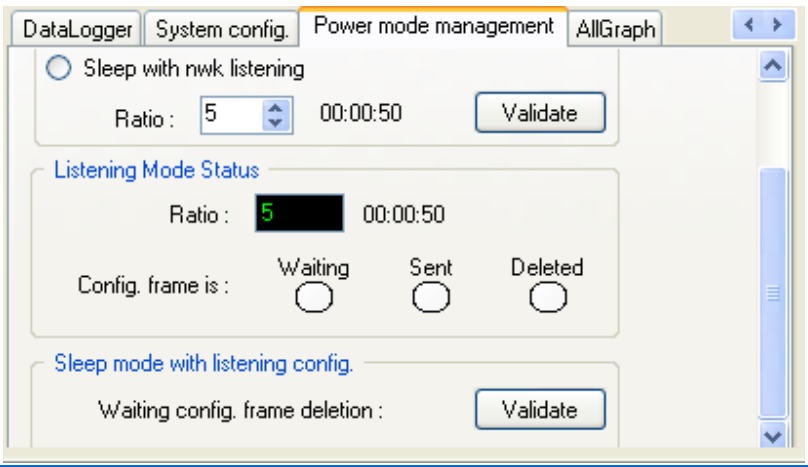


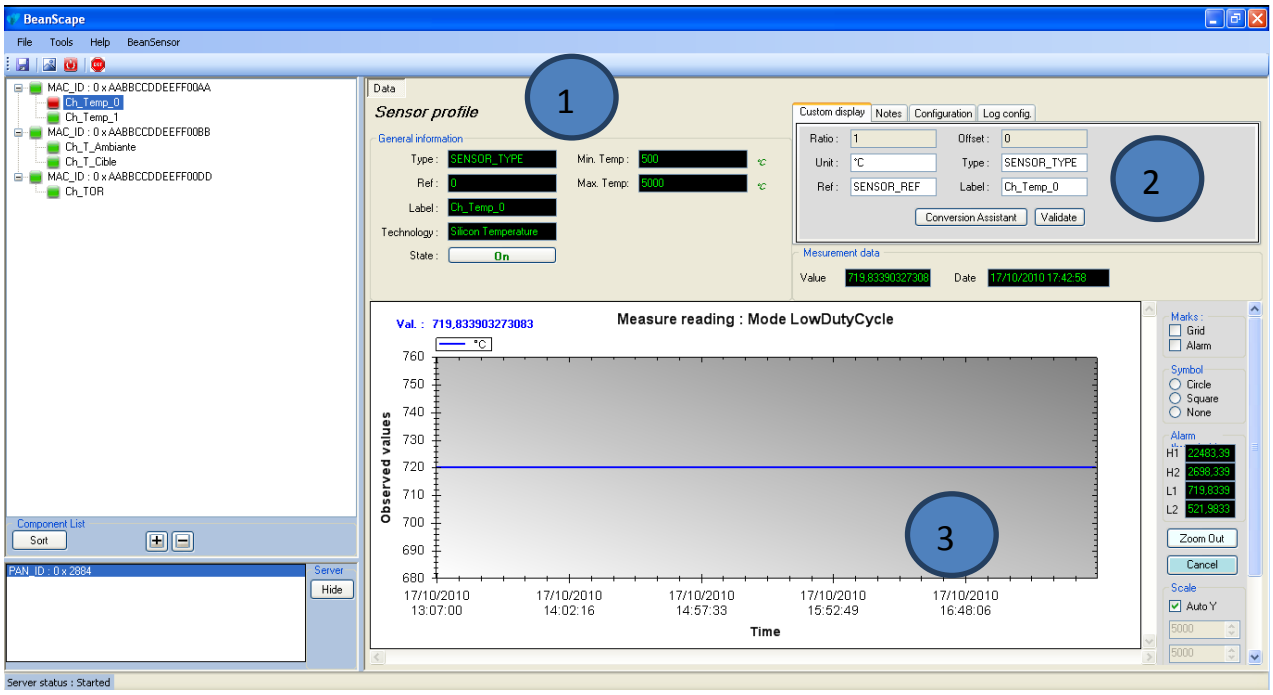
***Figure 14 : Power mode management –Second frame***

| Parameter | Description |
|---|---|
| ***Sleep mode configuration*** | ***Active:*** Sleeping mode is disabled. The BeanDevice® operates in Active power mode.<br>***Sleep:*** Sleeping mode is enabled<br>***Sleep with nwk listening:*** Sleep with network listening mode is enabled.<br>***Ratio***: Fix the Ratio of the listening cycle depending on the data acquisition low duty cycle.<br>***Example*** : If the data acquisition is 30 seconds, the Listening cycle will be 150 seconds. |
| ***Listening mode status*** | ***Ratio***: displays the latest Ratio value<br>***Waiting***: This led is ***green*** if an OTAC (Over-the-Air configuration) frame is pending for a transmission to the BeanDevice®<br>***Sent***: This led is ***green*** if an OTAC (Over-the-Air configuration) frame is transmitted to the BeanDevice®.<br>***Deleted***: This led is ***red*** if a pending OTAC (Over-the-Air configuration) is deleted |
| ***Sleep mode with listening config*** | By clicking on "validate", the pending OTAC frame is deleted |

## 9.4 SENSORS CONFIGURATION

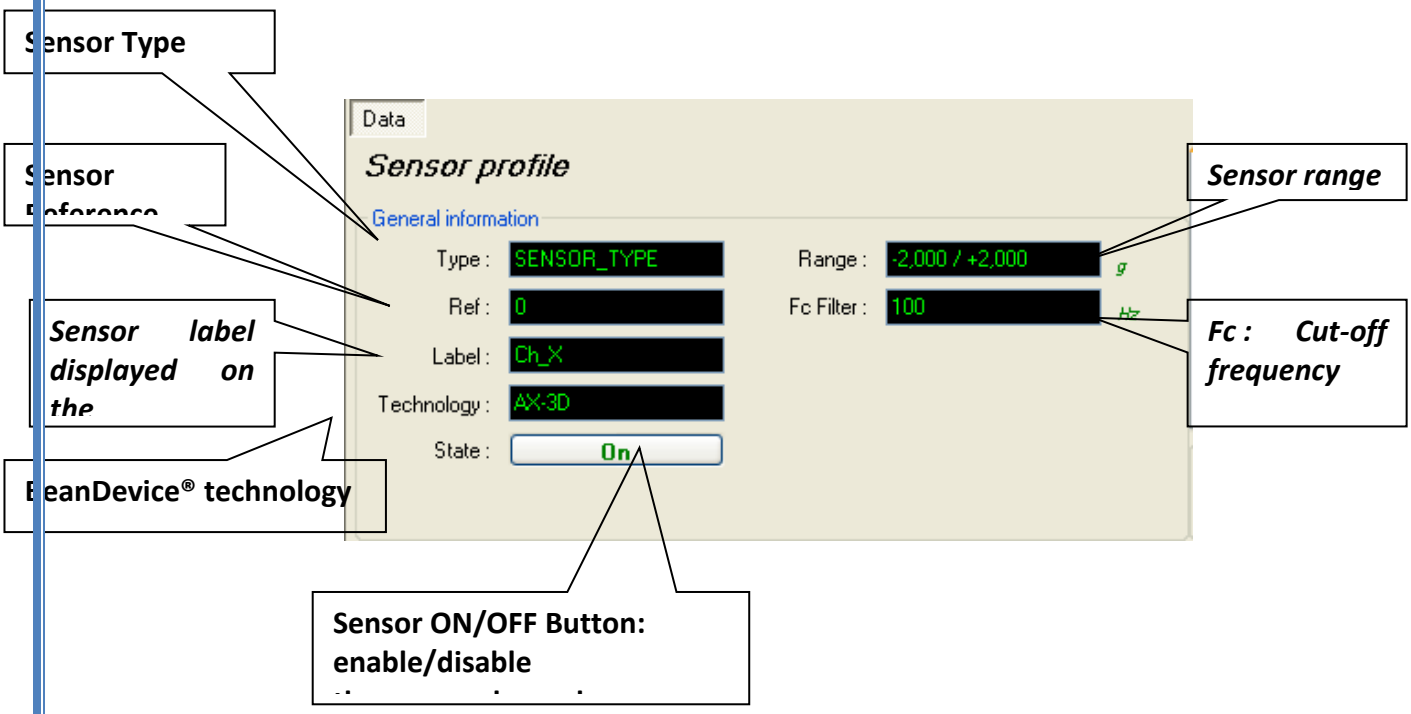
The screen « ***Sensor profile*** » consists of three parts:

1. ***General information on the measurement channel;***
2. ***Measurement channel configuration;***
3. ***A graph which displays in real-time sensor signals during data acquisition;***

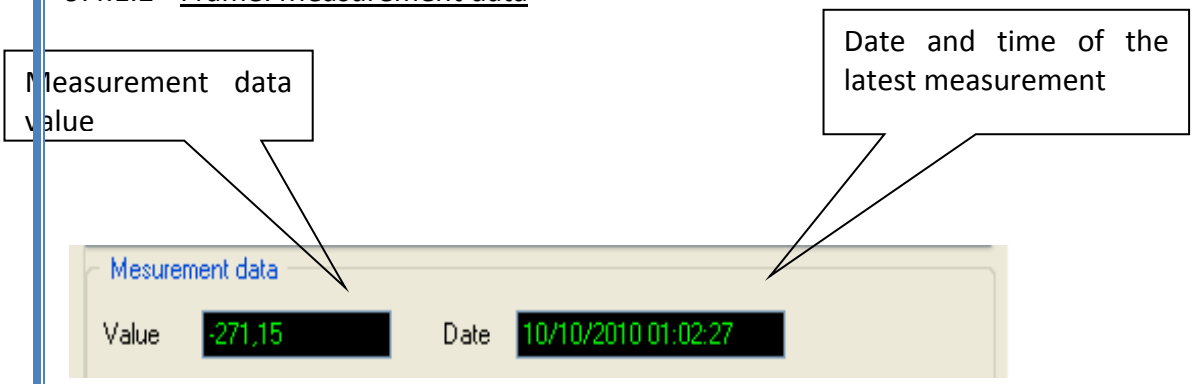


### 9.4.1 Sensor profile

9.4.1.1 Frame : General informations



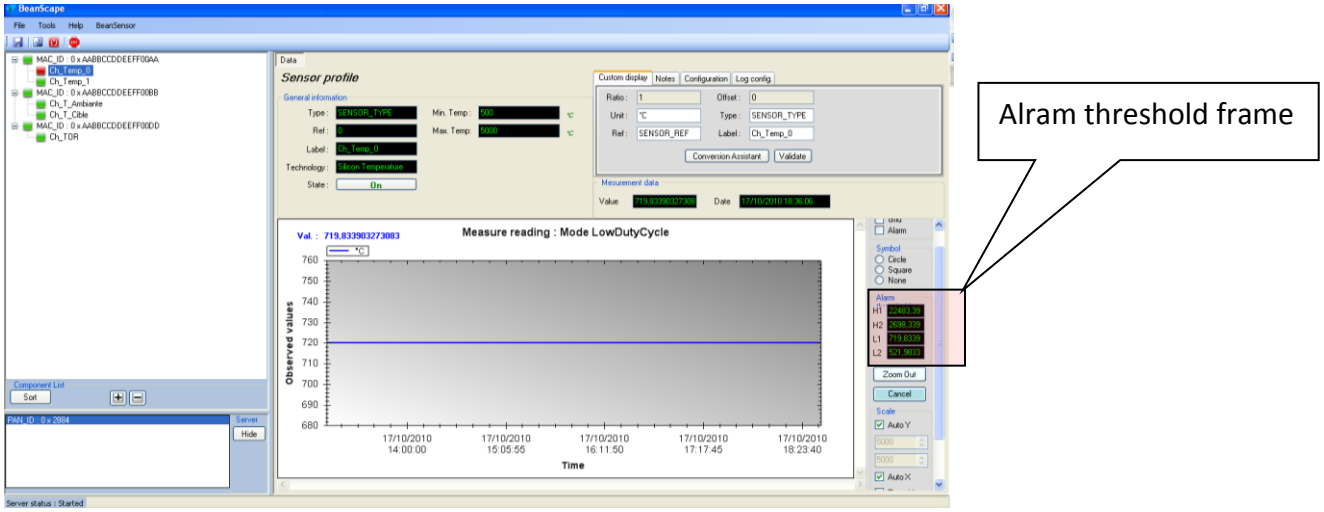

9.4.1.2 Frame: Measurement data



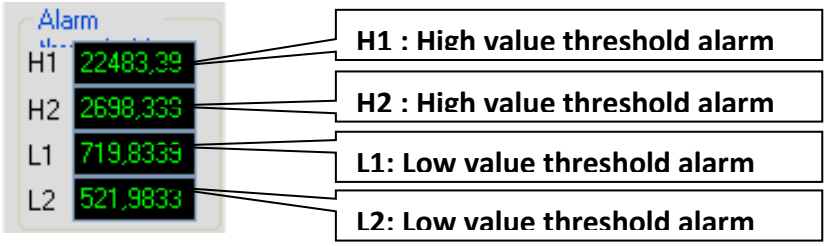

By default, sensor unit format is

- ✓ BeanDevice® AX-3D & AX-3DS : g
- ✓ BeanDevice® HI-INC : °

9.4.1.3 Frame : Alarm threshold




Alarm threshold are displayed in this frame:




***Depending on your sensor resolution, the displayed threshold value can differ from the reference value.***

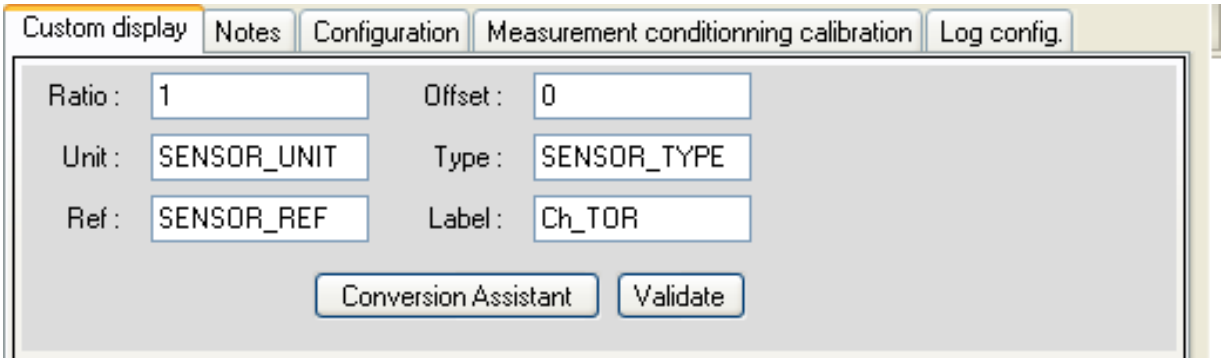
### 9.4.2 Sensor configuration & calibration

This frame contains a set of 5 tabs:

| | |
|---|---|
| Custom Display | • Allows the end user to customzie the sensor |
| Notes | • Contains notes relating to the BeanDevice® sensor |
| Configuration | • Sensor configuration interface. The user can configure the alarm thresholds related to the sensor<br>• Depending on the BeanDevice® version which is used, other configuration parameters are available |
| Measurement conditionning & calibration | • Sensor or measurement channel calibration |
| Log configuration | • Logs configuration on the BeanScape® |

#### 9.4.2.1 Tab: Custom display

These parameters allow the user to customize his sensor:




- ✓ ***Type***: Describe the sensor type (ex: load cell, pressure, Strain gage +/- 2 Mv/v, LVDT,…. )
- ✓ ***Unit***: customer sensor unit (bar, °C, l/h….)
- ✓ ***Ratio*** : Sensor Ratio coefficient (RAT);
- ✓ ***Offset*** : Sensor Offset Coefficient (OFF);
- ✓ ***Label***: Give a name to your sensor. (ex : Sensor on StatorMachine 1, sensor in Room 2 Floor 3)

***Measurement conversion formula:***

***Converted Measurement = Measurement x RAT + OFF***

***Example with a temperature sensor:*** By default the temperature unit is in degree Celsius. The user wants to convert the unit of his temperature sensor in degree Fahrenheit.

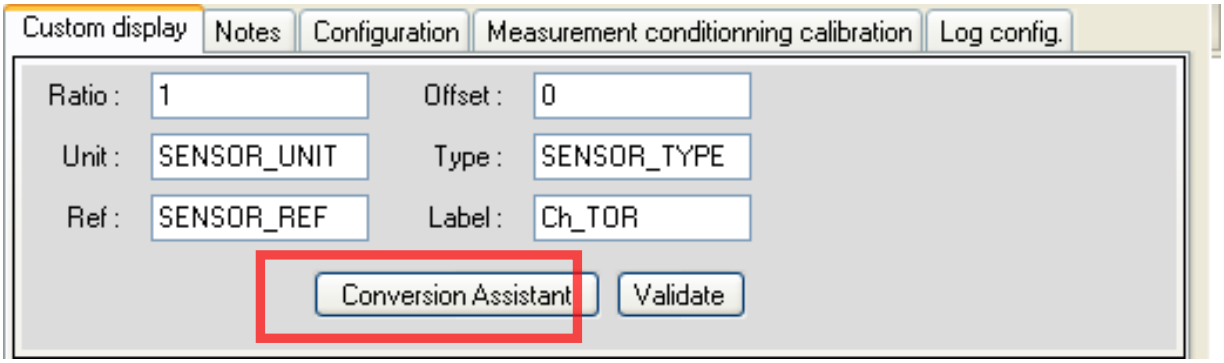
***Converted Measurement[°F] = Measurement[°C] x RAT + OFF***

With **RAT** = 1.8 and **OFF** = 32

***Conversion assistant***

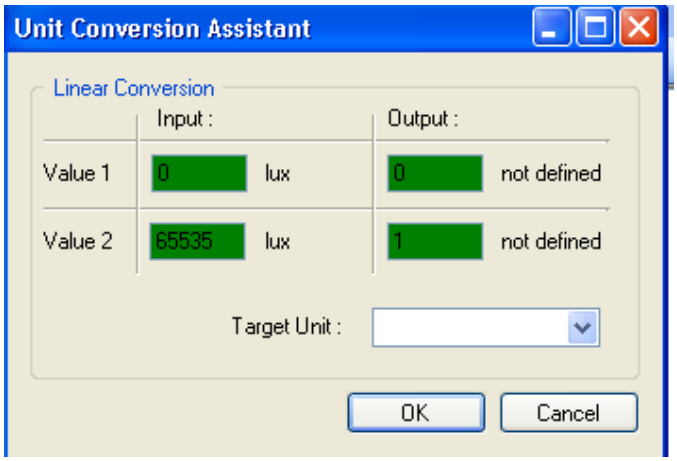
To avoid conversion error, a conversion assistant is available to help you to setup quickly your measurement channel of your BeanDevice®.

Click on conversion assistant from the tab "Custom display", a window will open allowing you to do a linear conversion.

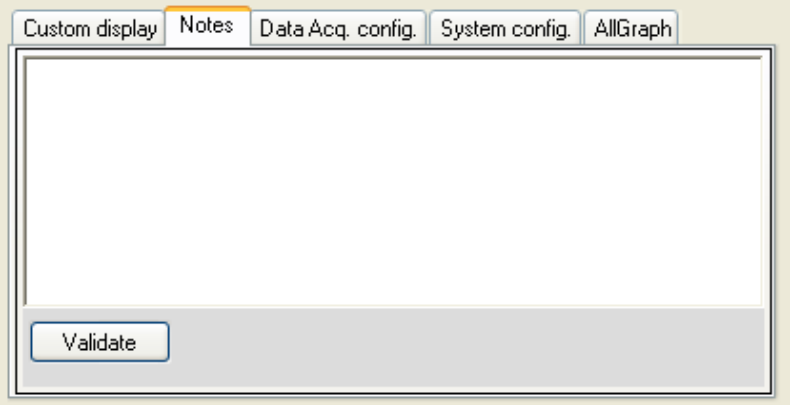



On the left column, the user can enter the non-converted measurement data. On the right column, the user can enter the converted measurement values with the desired unit.

The ratio and offset values are calculated automatically by the conversion assistant.

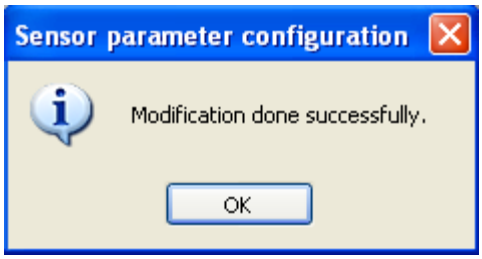


9.4.2.2 Tab : Notes



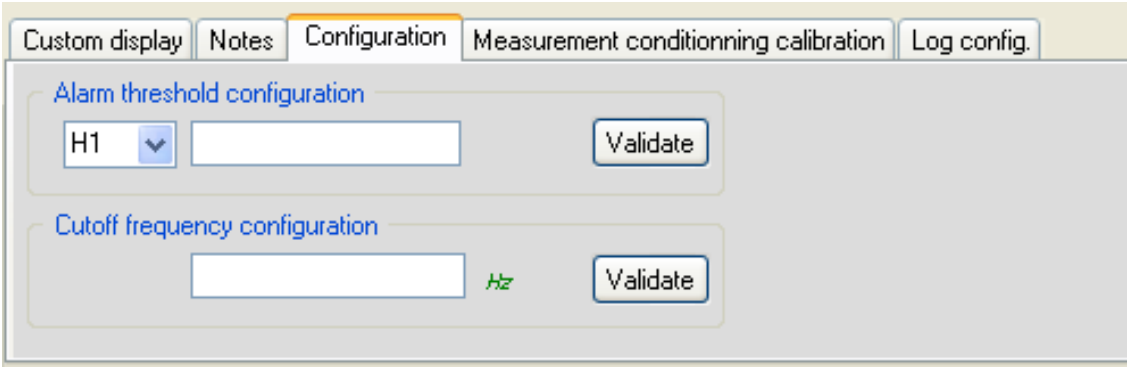

This field contains notes relating to the BeanDevice® sensor. To change this field, enter a value or free text and click the "Validate" button.

A new window opens; accept your modifications by clicking on "OK".




To backup your text click on the icon "Backup your Database"

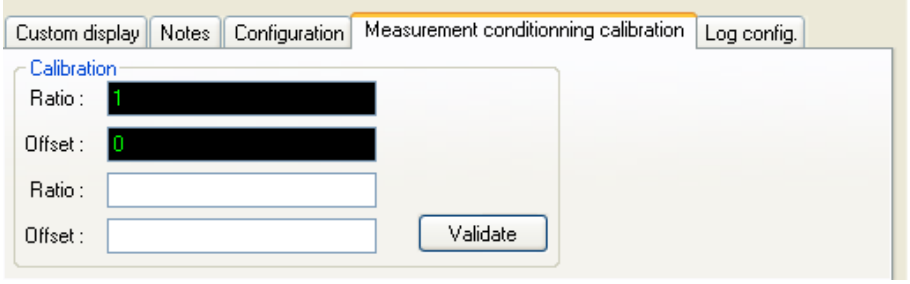
9.4.2.3 Tab: Configuration




| Parameter | Description |
|---|---|
| **Alarm threshold** | You can configure threshold high values (H1, H2) and low values (L1,L2) . In alarm mode, when a higher low threshold value is reached, an alarm notification is transmitted to the BeanGateway ;<br>✓ If the sensor value is higher than H1/H2, an alarm notification is send to the BeanGateway/BeanScape;<br>✓ If the sensor value is lower than L1/L2, an alarm notification is send to the BeanGateway/BeanScape;.<br>Threshold values must be organized in this manner:<br>H2>= H1 > L1>=L2 |

9.4.2.4 Tab : Sensor & Analog conditioning calibration

These coefficients are used to calibrate the external sensors & Light sensor




The BeanScape® provides a calibration interface for each measurement channel:

- ***Ratio*** : multiplier coefficient
- ***Offset***: adder/subtracter coefficient . its unit is the sensor unit.

*Calibrated_value* **=** **(***Ratio* **x** *Non_Calibrated_Value***)** **+** *Offset*

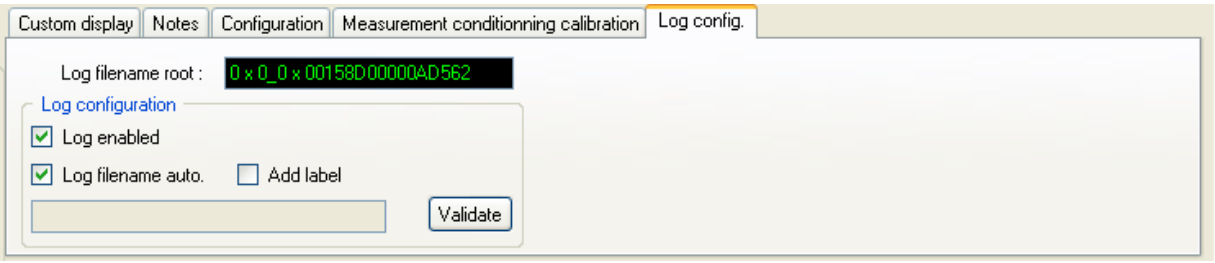
Enter the calibration coeffcients and then click on Validate.

***The calibrations coefficients are saved on the BeanDevice® flash memory and are conserved during the lifetime of your product.***

***WARNING: These calibration coefficients should be accessible to an advanced user. A wrong calibration will result in false measurements.***

9.4.2.5 Tab : Log configuration

***This tab should not be confused with the DataLogger function available on the Beandevice®:***




By default, Log file name is built with the measurement channel & BeanDevice® MAC Address:

< Sensor Channel Number > <MAC_ID>

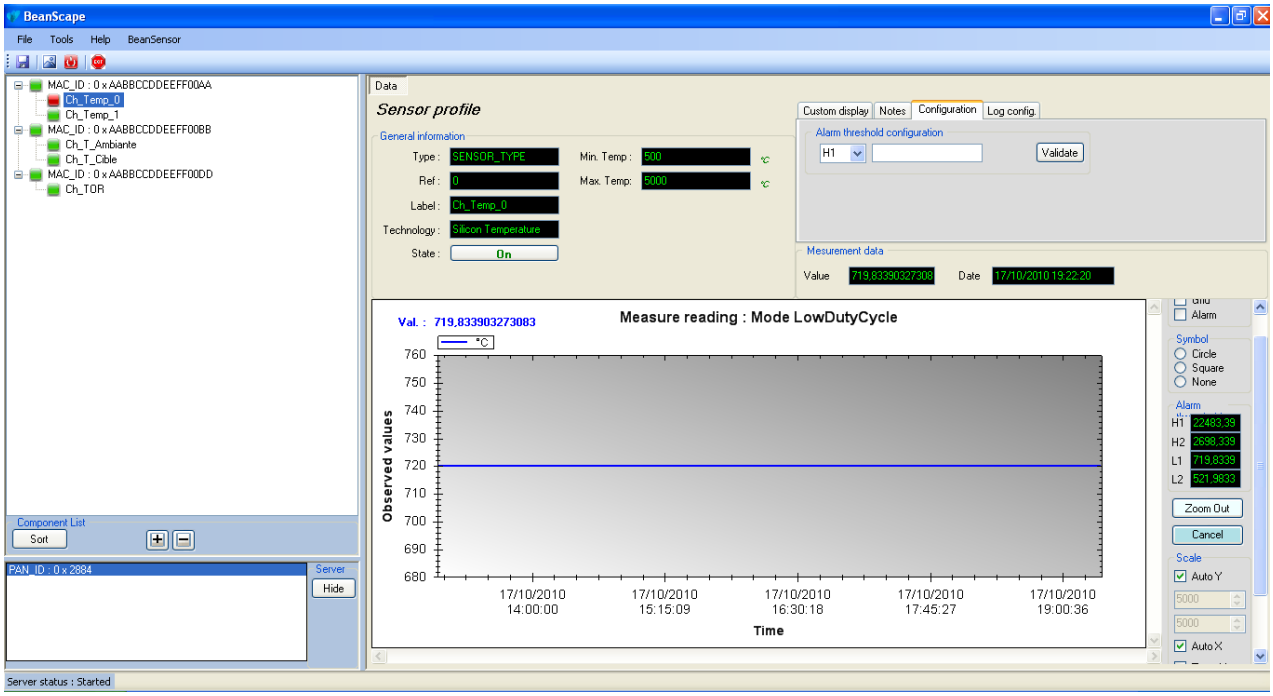
- ✓ ***Log enabled***: If checked, Log is enabled on the BeanScape®
- ✓ ***Log filename auto***.: If checked, Log file name is named automatically
- ✓ ***Add label***: If checked, the log file is renamed with the sensor label

Click on ***validate*** in order to validate all your modifications.

For users who want to rename the log file, two solutions are provided:

| | |
|---|---|
| ***Solution 1*** | ***Add automatically the channel "Label" in your log file name: <Label><Sensor channel Number> <MAC_ID>*** |
| ***Solution 2*** | ***The log file name can be fully customized: Uncheck the case « Log filename auto" and add your own label*** |

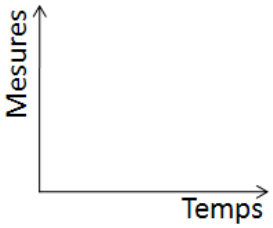
### 9.4.3 Graphical display




The chart is composed of two parts:

- ***Part 1***: This is a preview window, allowing you to observe sensors acquisitions:
- ***Part*** 2: A strip on the side composed of different frames allows customizing the graph;

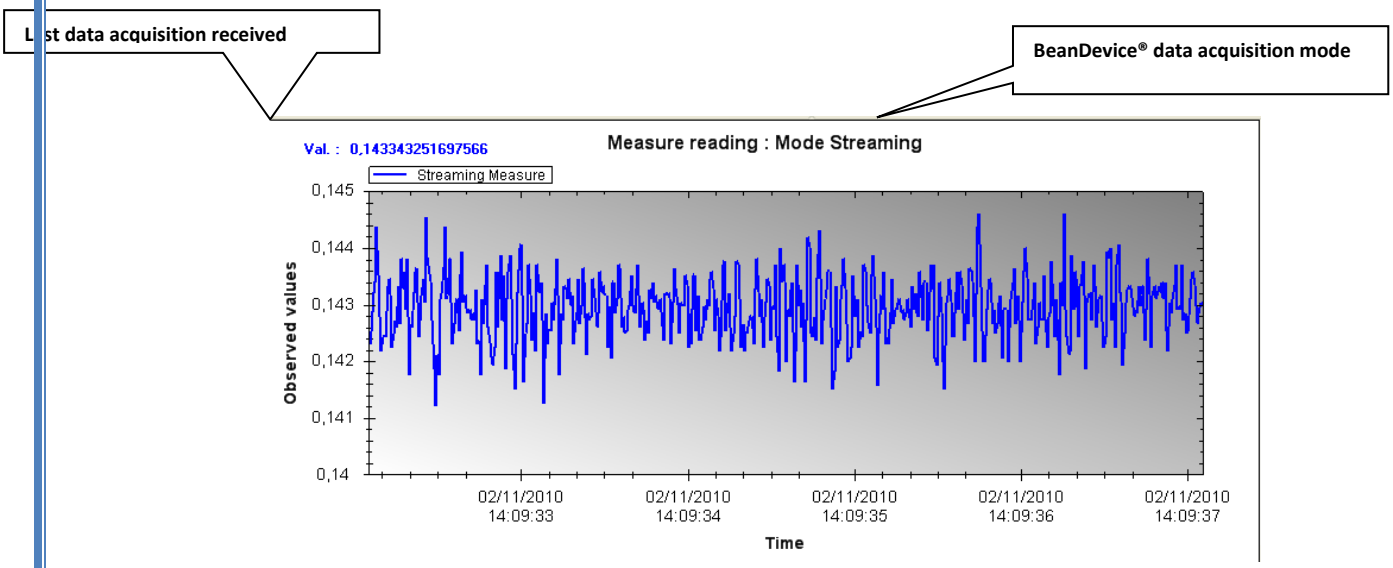
The graph has two axes:



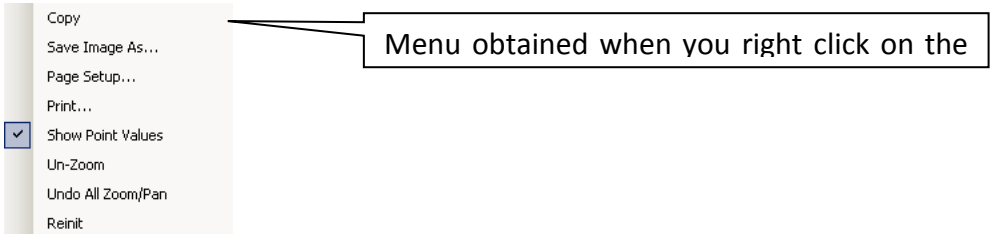

**Axe-X**: Timeline

**Axes-Y:** received sensor acquisitions

We can visualize the BeanDevice® data acquisition mode, and the last data acquisition obtained directly from the graph

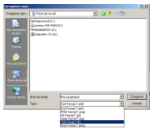



A right click on the graph allows a set of actions:




The meaning of each field of the menu is:

***Copy***: Copies the graph to the clipboard

**Save Image As …**: Save your graph 

The application offers a wide choice of type, for recording your graphs

Page Setup…: Use page setup to fine-tune pages before printing

**Print …**: Select your printer and start printing

**Show Point Values**: Enabling this option allows you to see the detail of each measurement plot


A zoom of the graph is possible using the mouse. This is possible only if one or both boxes "Zoom X and Y Zoom" is checked. Indeed, in this case the passage of the mouse cursor over the figure changes its shape. The form taken by the cursor is +.

Two options available to you to zoom the graph:

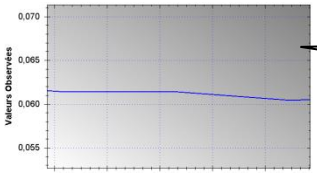
1) You use the mouse wheel

2) Or holding down the left mouse button, you select a chart area. Release the left mouse button causes a zoom selection.

9.4.3.1 Frame: Marks

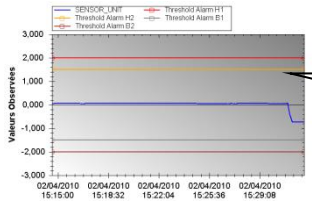
This frame consists of two check boxes that are "grid and alarm."

If this check box is ticked, a grid is displayed on the graph.



Grid displayed on the

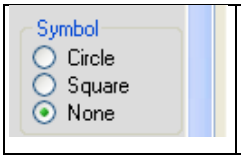
If this check box is ticked, all the alarms threshold H1/H2/L1/L2 are displayed on the graph



Alarms threshold H1/H2/L1/L2 are displayed on the graph

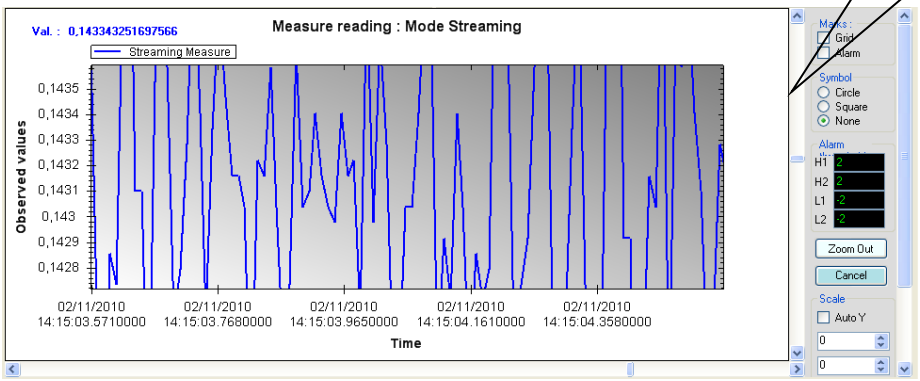
9.4.3.2 Frame: Symbols

From this frame you can select the display mode of action of the chart. Three types of symbols are available:

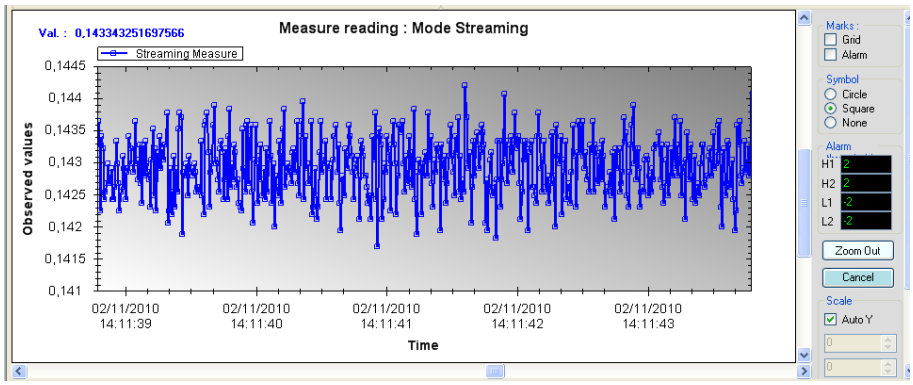


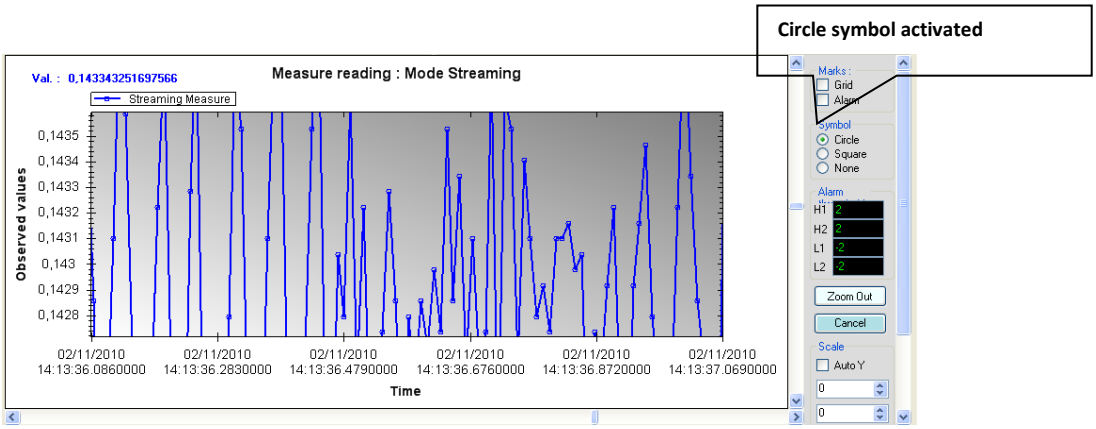

***Circle***: Brings up a point on each bar graph
***Square***: brings up a square on each measure of the graph
***None***: No logo is displayed on the graph

No symbol activated



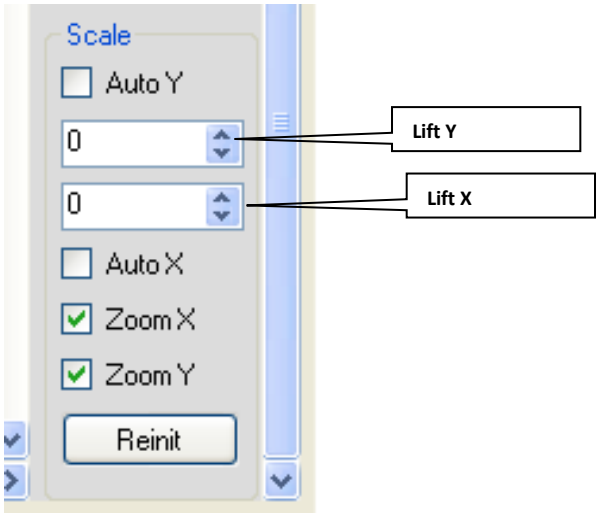

Square symbol activated




### 9.4.3.3 Frame : Scale

From this frame, you can customize the scaling of your graphics to suit your needs.



**Check box "Auto Y" and "Auto X**

- Select "Auto X" scales the X-axis automatically on the graph
- Select "Auto Y" scales Y-axis automatically on the graph

**Lifts Y and X**

- Where the "Auto Y" box is unchecked, you can set the limits for the graph from the field "X-lift"
- Where the "Auto X" box is unchecked, you can set the limits for the graph from the field "Y-lift"

**Checkbox "Zoom X and Y Zoom"**

These boxes are useful for performing a graph zoom from the mouse wheel, there are four cases:

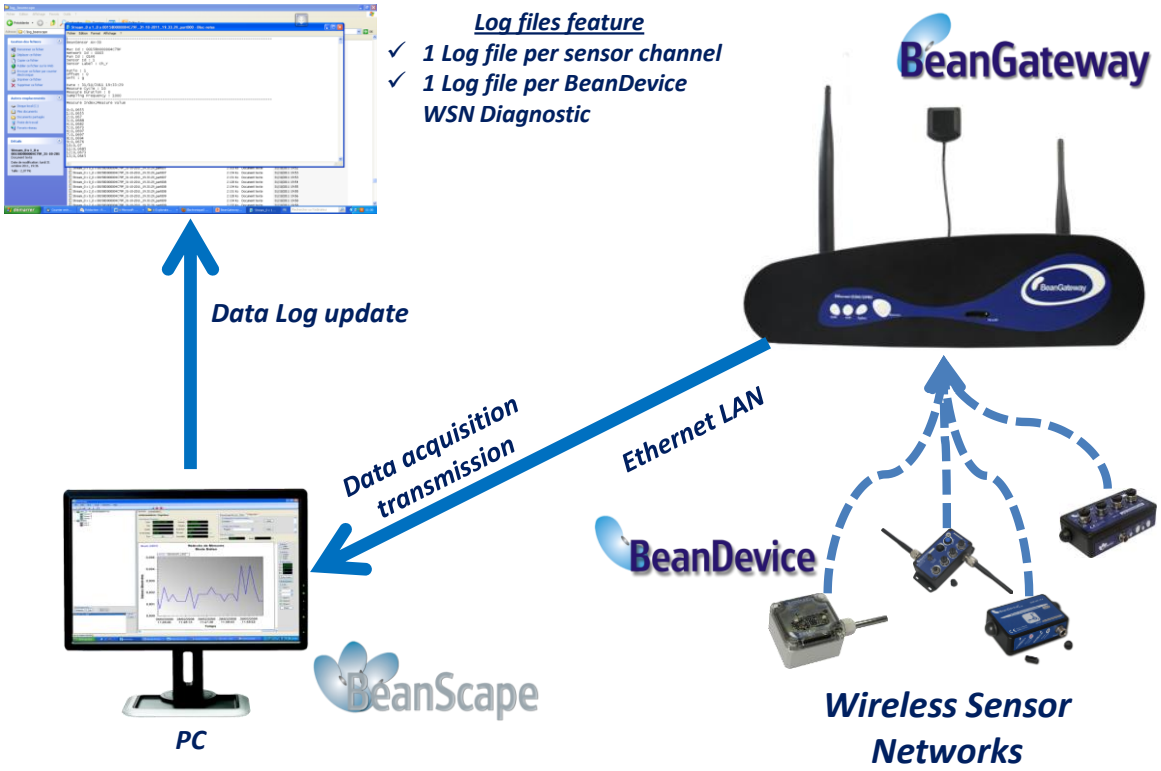
- ***Case 1***: Case "Zoom X checked" and "Zoom Y unchecked." The graph zoom will only affect the X axis.
- ***Case 2***: Case "Zoom X unchecked" and "Zoom Y ticked." The graph zoom will only affect the Y axis.
- ***Case 3***: Case "Zoom X checked" and "Zoom Y ticked." Zoom will affect both X and Y axes
- ***Case 4***: Case "Zoom X unchecked" and "Zoom Y unchecked." The zoom function from the mouse wheel is disabled.

## 9.5 DATALOGGER CONFIGURATION

***Please read the technical note TN_RF_007 – "BeanDevice® DataLogger User Guide "***

## 9.6 LOG FILE ORGANIZATION

### 9.6.1 Log File System Overview

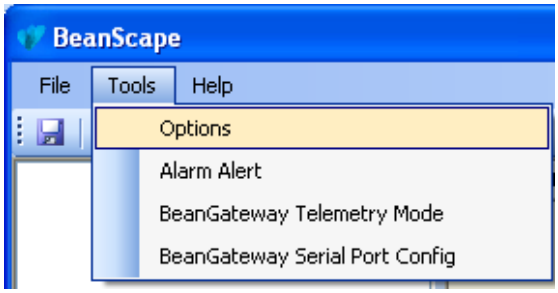



### 9.6.2 Log file directory

By default the Log file directory is: ***C:\log_beanscape***

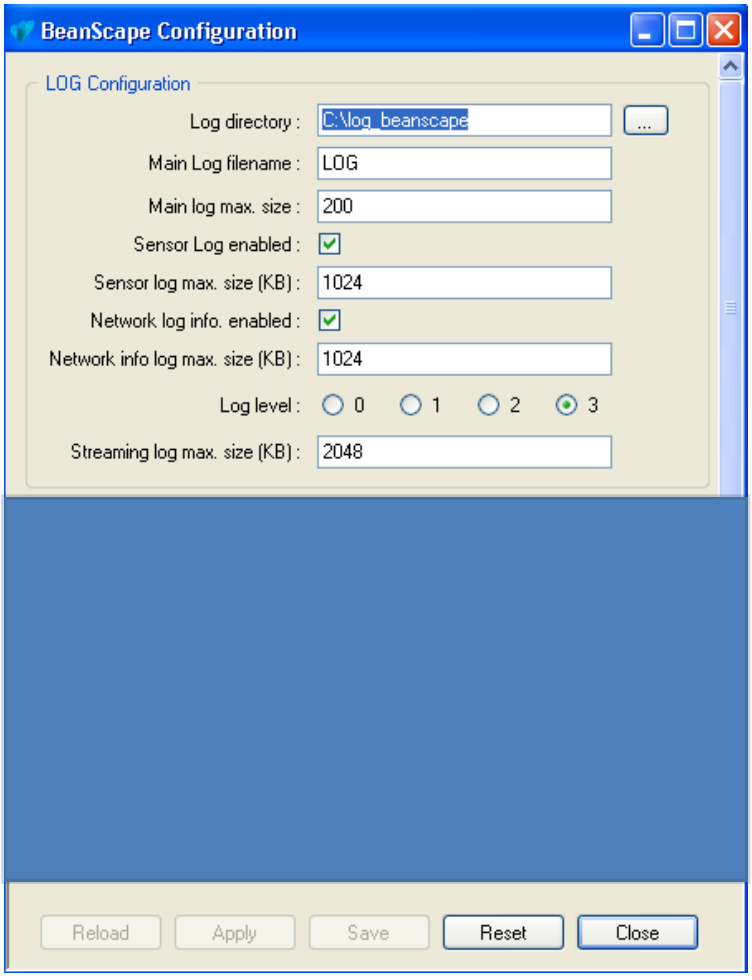
***The following procedure applies only for advanced users***

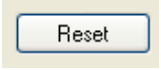
Click on the tab Tools then Options to configure advanced settings in BeanScape®:




This window lets you configure the logs, and the data cache.

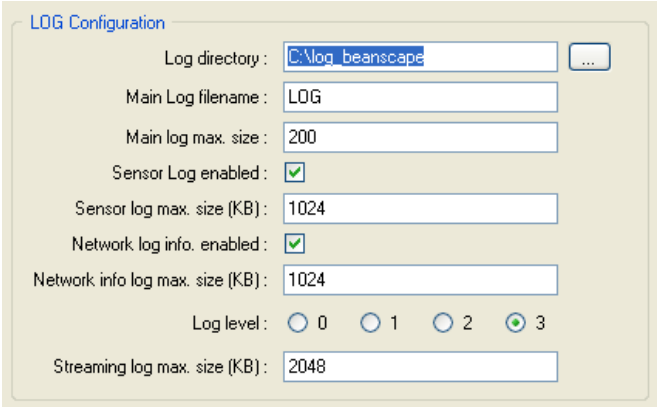
- You will see the following window :




- Clicking the button 

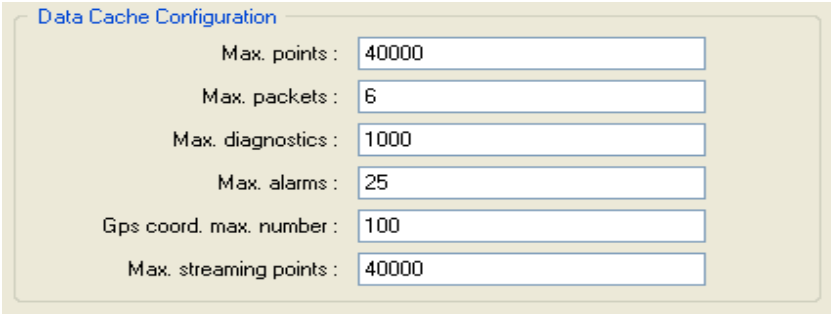
reverts back to its original configuration.

### 9.6.3 Logs configuration




- ***LOG directory***: Enter here the path/folder where you would want to save the LOG files.
- ***Main log filename***: Here you may enter the desired name in order to save the LOG file.
- ***Main log max. size (KB):*** Maximum file size in Kilobytes (KB) for your principal LOG file
- ***Enable LOG sensors***: Check this box if you want to enable the sensor(s) data acquisition in your LOG file
- ***Maximum LOG sensor (KB)*** : Maximum size in Kilobytes (KB) of your LOG sensor files
- ***Enable Network LOG info.*** : Check this box if you want to enable network information in your LOG file
- ***Maximum LOG network info (KB)*** : Maximum size in Kilobytes (Kilo Octets) for your network information LOG file
- ***LOG level*** : Display priority LOGS

### 9.6.4 Cache Data Configuration (for Graph)




- ***Maximum number of points***: Set here the maximum number of points displayed on the BeanScape® graph
- ***Maximum number of package***: Set here the maximum number of packets displayed on the BeanScape® graph

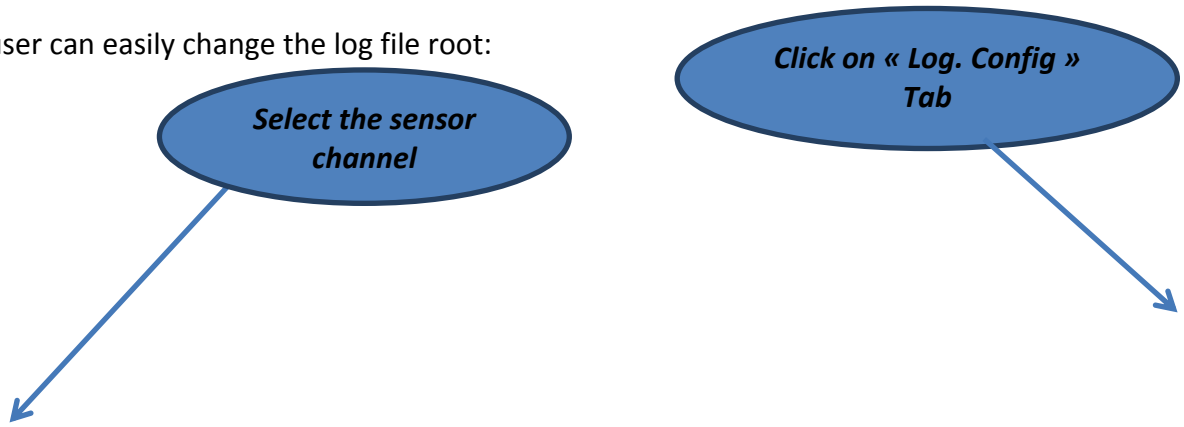
- ***Max number of diagnosis***: Set here the maximum number of diagnosis displayed on the BeanScape® graph
- ***Max number of alarms***: Set here the maximum number of alarms displayed on the BeanScape® graph
- ***Maximum number of GPS coordinates***: Set here the maximum number that GPS information displayed on the BeanScape® graph
- ***Maximum streaming points***: Set here the maximum number of points displayed in Streaming/Streaming Packet on the BeanScape® graph

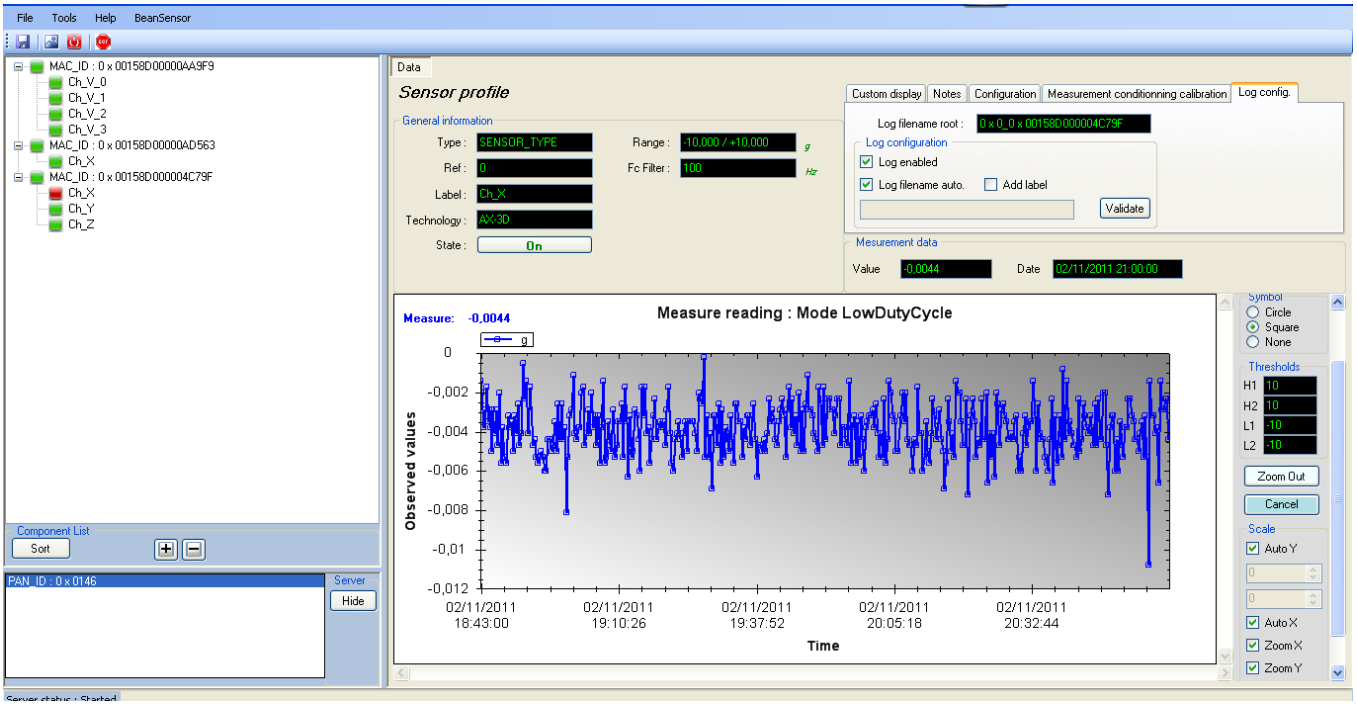
***Please note that the values backed up by the BeanScape® may affect the memory capacity of your computer depending upon the size of every file.***

### 9.6.5 Log filename root

For each sensor channel a log file is automatically created by the BeanScape®.

The user can easily change the log file root:






***This tab should not be confused with the DataLogger feature available on the Beandevice®.***

Read section Log configuration for further informations

### 9.6.6 Log file organization in "Streaming"/"Streaming Packet" mode

9.6.6.1 Log file naming format

In streaming or Streaming packet mode, log file is built with a different format:

Stream_Sensor_channel_MAC_ID_DATE_partXXX

- ✓ ***Sensor channel = Sensor channel***
- ✓ ***MAC_ID: BeanDevice® MAC ID***
- ✓ ***DATE: date when the streaming mode starts***
- ✓ ***partXXX : Log file sequence number, part000 corresponds to the first log file***

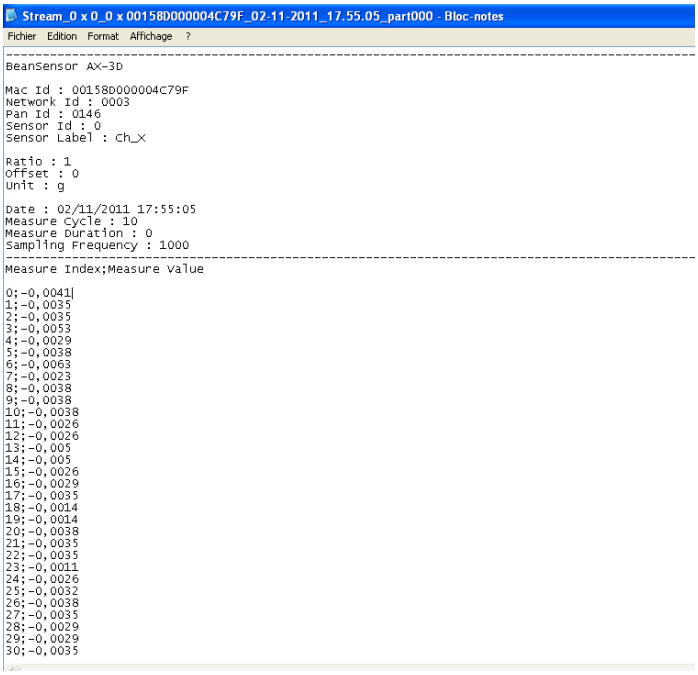
***Example***:

Stream_0 x 0_0 x 00158D000004C79F_02-11-2011_17.55.05_part000

Stream_0 x 2_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

Stream_0 x 1_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

### 9.6.7 Log file analysis




The date which is displayed in the log file corresponds to the date when the streaming mode starts.

***Measure index*** allows the user to use a timestamp, the time value between the Index N and N+1 corresponds to the period rate.

***Example***: Data acquisition starts at 17h55min05s

A data acquisition with a measurement index of 30 (value -0,0035) corresponds to a time 17h55min05s30ms.

# 10. BEANDEVICE® MAINTENANCE & SUPERVISION (FOR EXPERIENCED USER)

This section allows to an experienced user to configure correctly the Wireless Sensor Networks.

## 10.1 HOW TO OPTIMIZE THE BATTERY AUTONOMY ON YOUR BEANDEVICE®

The battery autonomy depends on several parameters:

- ✓ The environment where the BeanDevice® is deployed
- ✓ Data acquisition mode which is configured

The table below presents the BeanDevice® current consumption during radio TX or during Sleep mode:

| *BeanDevice® version* | *Current consumption during radio TX at 25°C, powered by a battery of 3,6V* | *Current consumption in sleep mode at 25°C, powered by a battery of 3,6V* |
|---|---|---|
| BeanDevice® AN-mV | 60-61 mA (external sensor power supply not included) | < 40 uA |
| BeanDevice® AN-420 | 60-61 mA (external sensor power supply not included) | < 40 uA |
| BeanDevice® AN-V | 60-61 mA (external sensor power supply not included) | < 40 uA |

***For further information, please read the technical note RF_TN_002 V1.0 - Current consumption in active & sleeping mode***

The following table gives you a list of recommendations in order to extend the battery autonomy of your BeanDevice®:

| Influence factors on battery autonomy | Observations | Recommendations |
|---|---|---|
| ***Sleep power mode on the BeanDevice®*** | The BeanDevice® can be configured with sleep mode from the BeanScape® interface | By activating sleep power mode on your BeanDevice®, you will dramatically decrease battery autonomy of your BeanDevice®. By activating sleep mode, the BeanDevice® current consumption can decrease from 30 mA to 10-45 micro-amperes.<br>***For further information, please read the technical note TN_RF_010 – « BeanDevice® Power Management »*** |
| ***Sampling rate in streaming mode*** | The higher your sample rate, the higher the RF transmissions are more consistent and your consumption will grow. | Choose the right sampling rate on your BeanScape® interface. |
| ***TX Power*** | More your TX power is important more the current consumption of the BeanDevice® is important | If your wireless range is low, try to use a lower TX Power. |
| ***Packet Error Rate (PER)*** | A high packet error rate can cause a higher retransmission data and this increase the current consumption. | Try to replace your BeanDevice® in an area where the radio link is much better (see Link Quality Indicator value). |

## 10.2 OVER-THE-AIR CONFIGURATION (OTAC) PARAMETERS BACKED UP ON FLASH

The BeanDevice® integrates an internal flash memory used for backuping OTAC (Over-the-air configuration) configuring parameter backups and restoration.

This memory is organized into several levels:

| | |
|---|---|
| Level 1 | • End-user parameters |
| Level 2 | • Sensor calibration coefficients |
| Level 3 | • Network maintenance (only fo experts) |
| Level 4 | • Battery/Primary celle calibration |

### 10.2.1 Level 1: End-user OTAC parameters

The following table presents all the defaults configuration parameters:

To restore these defaults parameters, you must perform a ***Network context deletion***. The "**Network**" push button is outside the product.

| *Parameter* | *BeanDevice® version* | | |
|---|---|---|---|
| | *AN-420* | *AN-V* | *AN-mV* |
| *Power Mode* | *Active* | *Active* | *Active* |
| *Data Acquisition duty cycle* | *10s* | *10s* | *10s* |
| *Acquisition duration time* | *OK* | *OK* | *OK* |
| *Sampling rate* | *OK* | *OK* | *OK* |
| *Data Acquisition mode* | *LowDutyCycle* | *LowDutyCycle* | *LowDutyCycle* |
| *TX Power* | *+18dBm* | *+18dBm* | *+18dBm* |
| *Alarms Threshold* | *H1 :20*<br>*H2 :20*<br>*S2 :4*<br>*S1 :4* | *H1 :10*<br>*H2 :10*<br>*S2 :0*<br>*S1 :0* | *H1 :20*<br>*H2 :20*<br>*S2 :0*<br>*S1 :0* |
| *Pre-process duration time* | *30 ms* | *30 ms* | *30 ms* |
| *Sensor polarity* | *N.A.* | *Unipolar* | *Unipolar* |

***Level 2, 3 & 4 of Configuration parameters are not affected by network context deletion (by hardware or software)***

### 10.2.2 Level 2: Sensor calibration parameters

The table below shows the sensor calibration parameters depending on BeanDevice® version:

| Parameter | BeanDevice® Version | | |
|---|---|---|---|
| | AN-420 | AN-V | AN-mV |
| Sensor gain | OK | OK<br>2 gains value (unipolar & bipolar) | OK<br>2 gains value (unipolar & bipolar) |
| Sensor offset | OK | OK<br>2 offset value (unipolar & bipolar) | OK<br>2 offset value (unipolar & bipolar) |

### 10.2.3 Level 3: Network maintenance (only for expert in wireless sensor networks)

The table below shows the sensor calibration parameters depending on *BeanDevice®* version:

| Parameter | BeanDevice® Model | | |
|---|---|---|---|
| | AN-420 | AN-V | AN-mV |
| Software reset counter | OK | OK | OK |
| Physical reset counter | OK | OK | OK |
| Threshold value on software reset | OK | OK | OK |

### 10.2.4 Level 4: Primary cell/Rechargeable battery calibration

The table below shows Primary cell/Rechargeable battery calibration depending on ***BeanDevice®*** version:

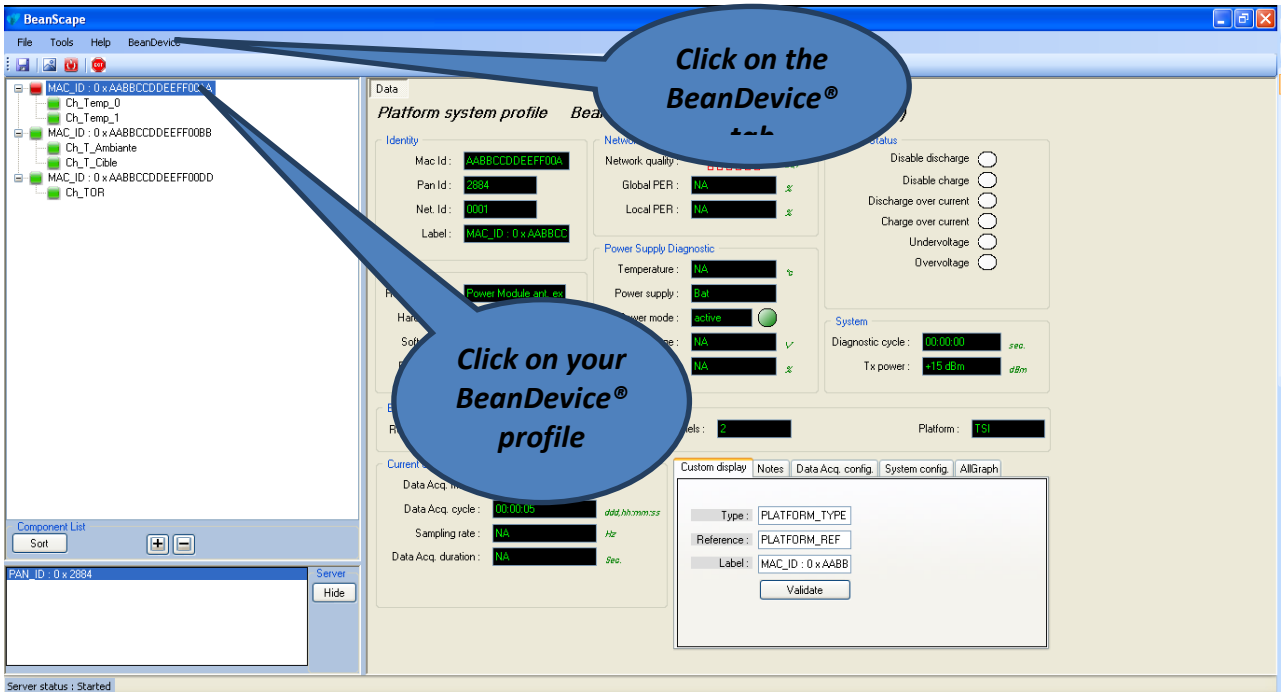
| Parameter | BeanDevice® Model | | |
|---|---|---|---|
| | AN-420 | AN-V | AN-mV |
| ***Battery, primary cell ID*** | OK | OK | OK |
| ***Calibration batterie/pile*** | OK | OK | OK |

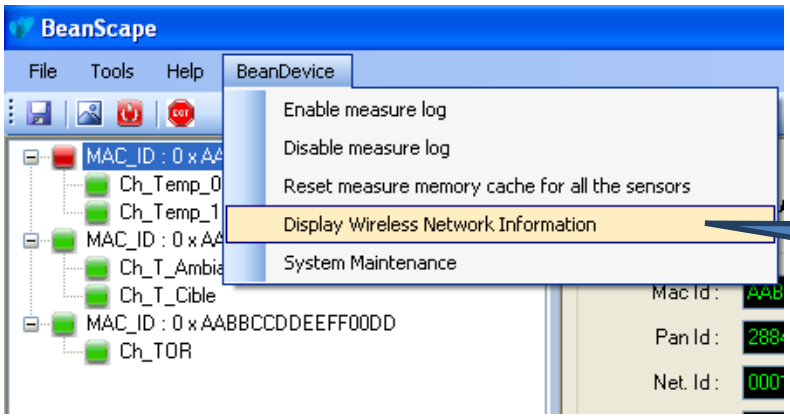
## 10.3 NETWORK DIAGNOSTIC FROM YOUR BEANSCAPE® SOFTWARE

The BeanScape® provides network diagnostic information which is described in this chapter.

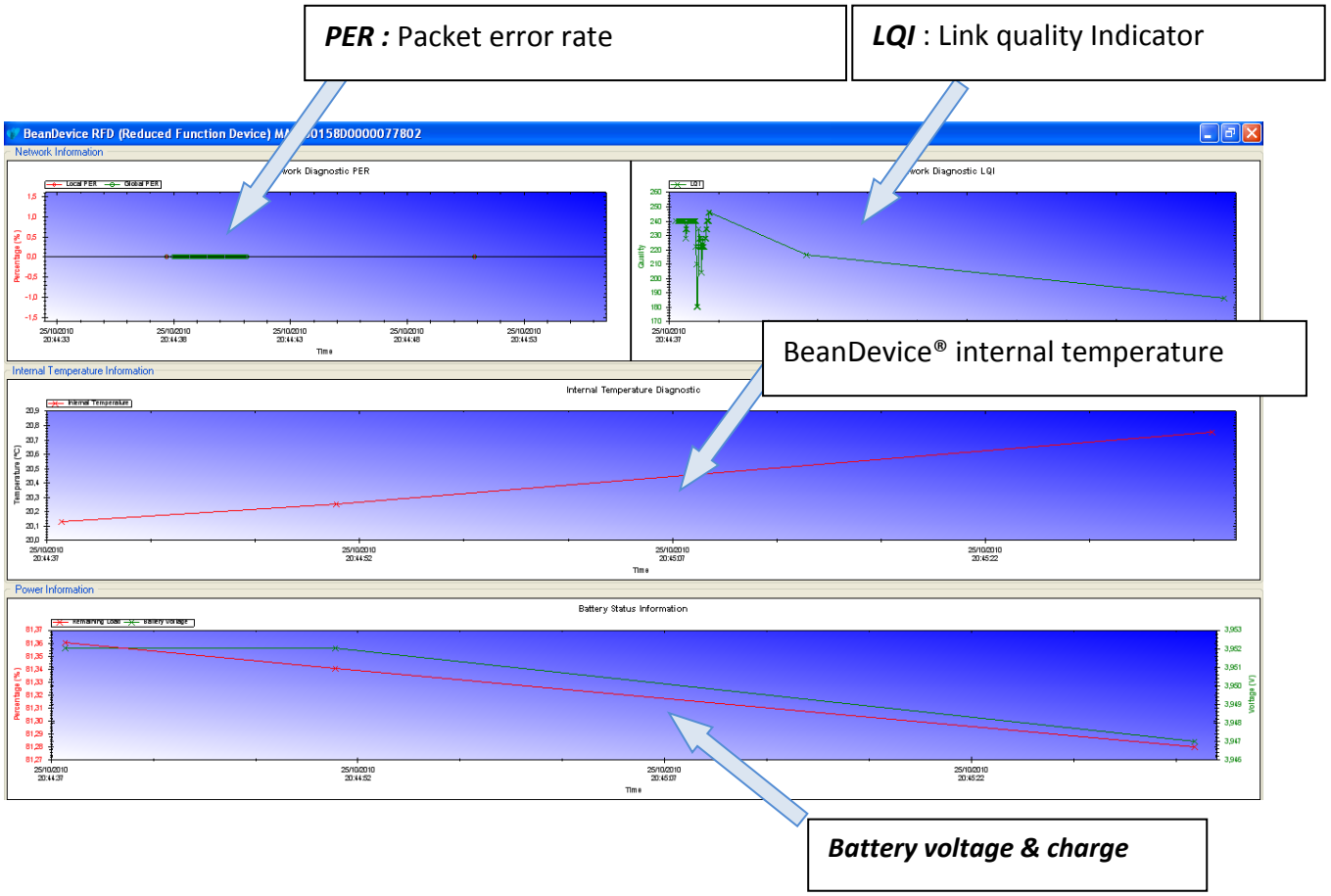
### 10.3.1 Displaying Network information

1. Launch your BeanScape® application
2. Select your BeanDevice® profile, a new tab "BeanDevice" will appear in your BeanScape® toolbar;
3. Click on this tab, and then click on "View History Network".


Click on the BeanDevice® tab
Click on your BeanDevice® profile


BeanScape
File
Tools
Help
BeanDevice
Enable measure log
Disable measure log
Reset measure memory cache for all the sensors
Display Wireless Network Information
System Maintenance
Click on « Display wireless network Information »

***A new window occurs:***




10.3.1.1 Packet Error Rate

**Packet error rate** (PER) is the number packet errors divided by the total number of transferred packet during a studied time interval. PER is a unit less performance measure, often expressed as a percentage number.

PER is only available with IEEE 802.15.4 Network, it represents the ratio of "lost data/data send" between the BeanDevice® and the BeanGateway®.

10.3.1.2 LQI (Link Quality Indicator )

LQI (Link Quality Indicator) represents the radio signal quality in your Environment. It is possible that LQI is low due to EMC interference or metal presence in the environment.

**If you encounter such problems, several solutions are proposed to increase your LQI:**

- ✓ Use the Maximum TX Power on your BeanDevice. The maximum TX Power authorized in Europe for indoor application is 12 dBm. For Outdoor application, you are authorized to extend the TX Power

to 18 dBm. You can easily configure the TX Power on your BeanDevice from your BeanScape WSN software supervision.

- ✓ Try to configure your receiver antenna and your transmitter antenna on the same antenna pattern (cf. the Beam with of your antenna)
- ✓ Use a high gain antenna ( in outdoor use only) for a better RF Link Budget
- ✓ Fix your BeanDevice & BeanGateway on a top of a mast or a building.

***For further information, read the application note on "How to extend your wireless range?"***

10.3.1.3 Internal temperature monitoring

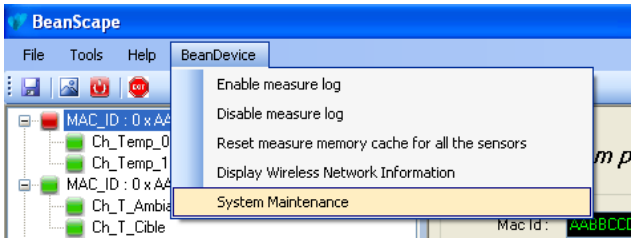
An internal temperature sensor is used for onboard & battery temperature monitoring

10.3.1.4 Battery charge monitoring

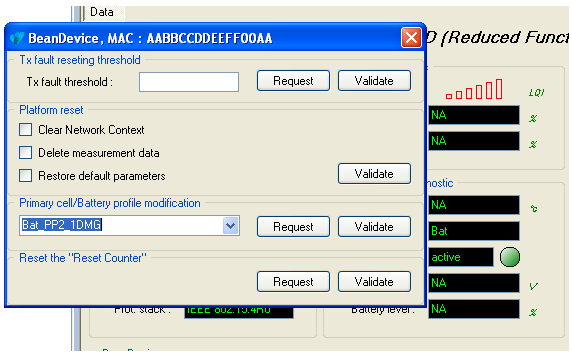
Battery charge is based on current accumulation. The BeanDevice® integrates a current accumulator circuit which facilitates remaining capacity estimation by tracking the net current flow into and out of the battery. Current flow into the battery increments the current accumulator while current flow out of the battery decrements it.

Voltage measurement corresponds to battery voltage.

### 10.3.1 System maintenance




***Warning: This area is reserved for persons with extensive experience in Wireless sensor networks. Configuring wrongly on such an interface may cause malfunction your BeanDevice®.***

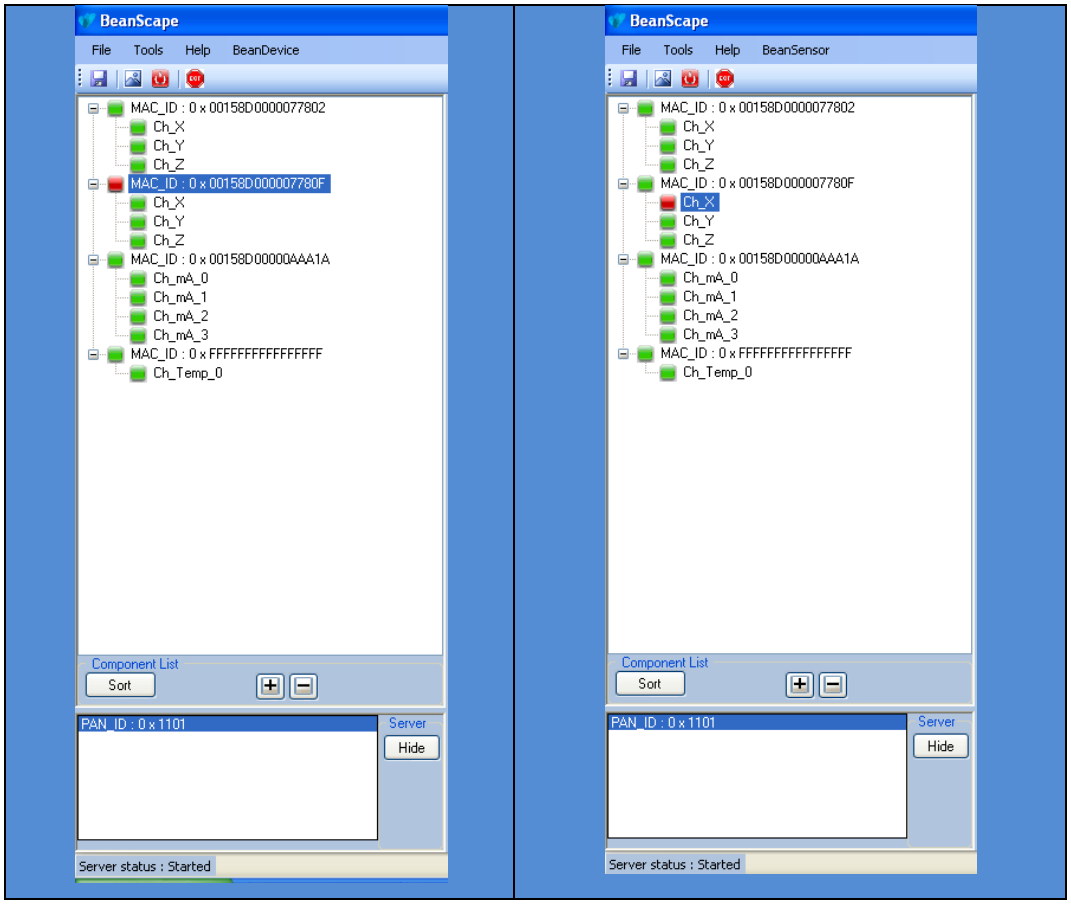



- ***TX Fault Threshold***: Not available
- ***Clear Network context (software)*** : This option may be substituted for the push button "Network". However, when the BeanDevice ® is not available (not powered or in sleeping mode) this option is not usable.
- ***Delete measurement data***: Delete stored measurements.
- ***Restore default parameters***: This function restores all the default parameters stored on the BeanDevice flash memory
- ***Primary Cell/Battery profile modifications*** : You can change your primary cell / battery profile here;
- ***Reset the « Reset counter »*** : resets the reset counter which is used for BeanDevice reboot ;

### 10.3.1 Scrolling menu « BeanSensor »

The BeanSensor® scrolling menu provides access to additional features: like the multi-graph mode (display of multiple windows on a graph measuring the same screen), deleting graphs displayed and the activation / deactivation of logging measurements.

To access to this scrolling menu, click on the sensor attached to your BeanDevice®. You will then see the BeanSensor® scrolling menu appearing.

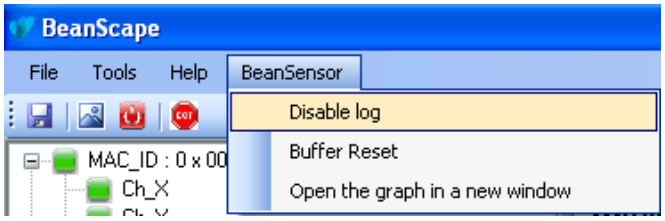


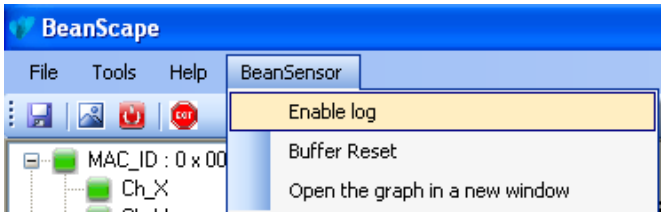

By clicking on the scrolling menu « BeanSensor », you can access to the following features :

10.3.1.1 Disable/Enable log

All the data received on the BeanScape® are stored in a log file in CSV format.

This feature allows you to enable / disable data logging on your log file.



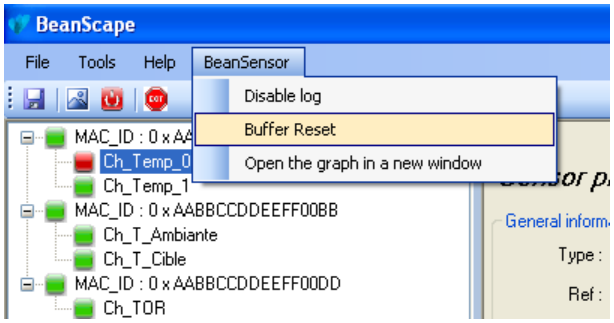

***For further information about CSV log file, please read the BeanScape® user manual.***

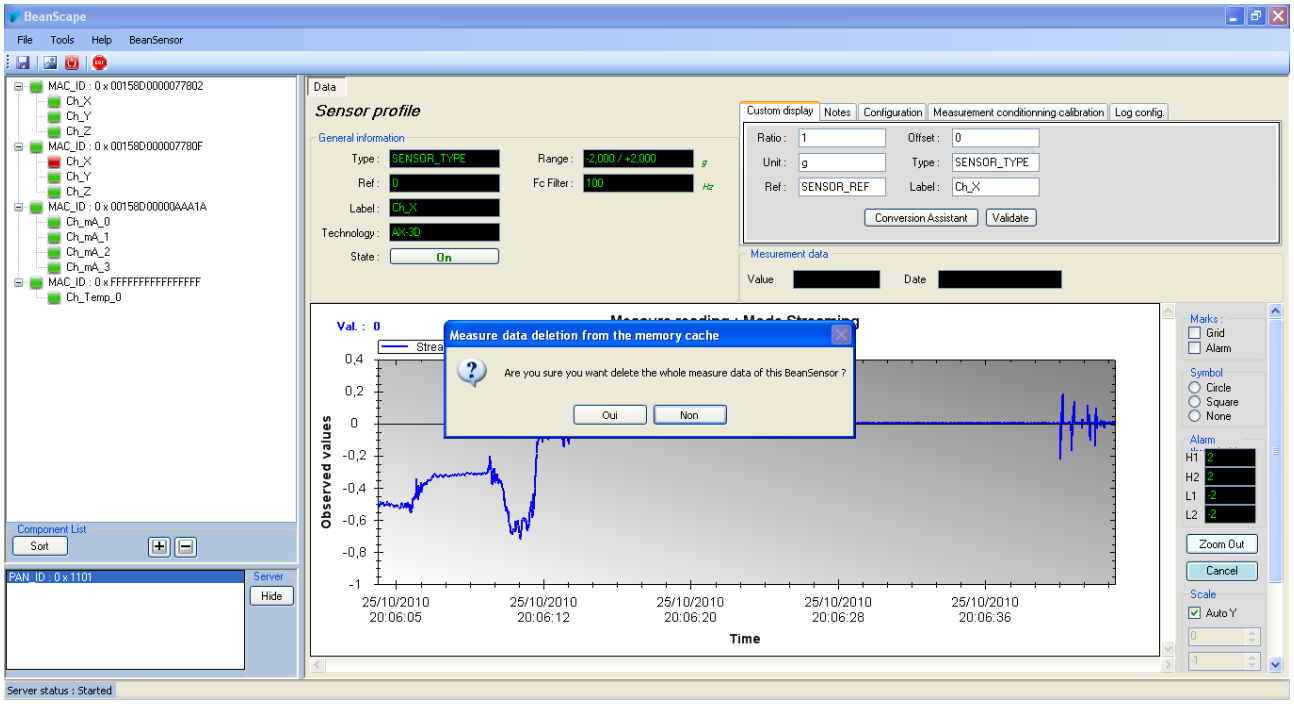
10.3.1.2 Buffer reset

This function clears the graphical display concerning recorded measurements of your sensor. The data stored in a log are not affected by this function.

By clicking on « Buffer reset », a second window appears asking you to confirm your choice:

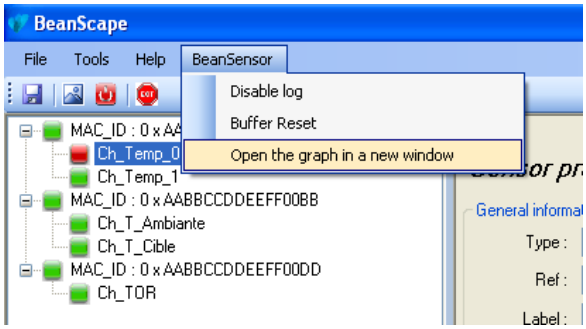
- Yes, you accept to delete the whole measure data of this BeanSensor;
- No, don't delete the whole measure data of this BeanSensor;



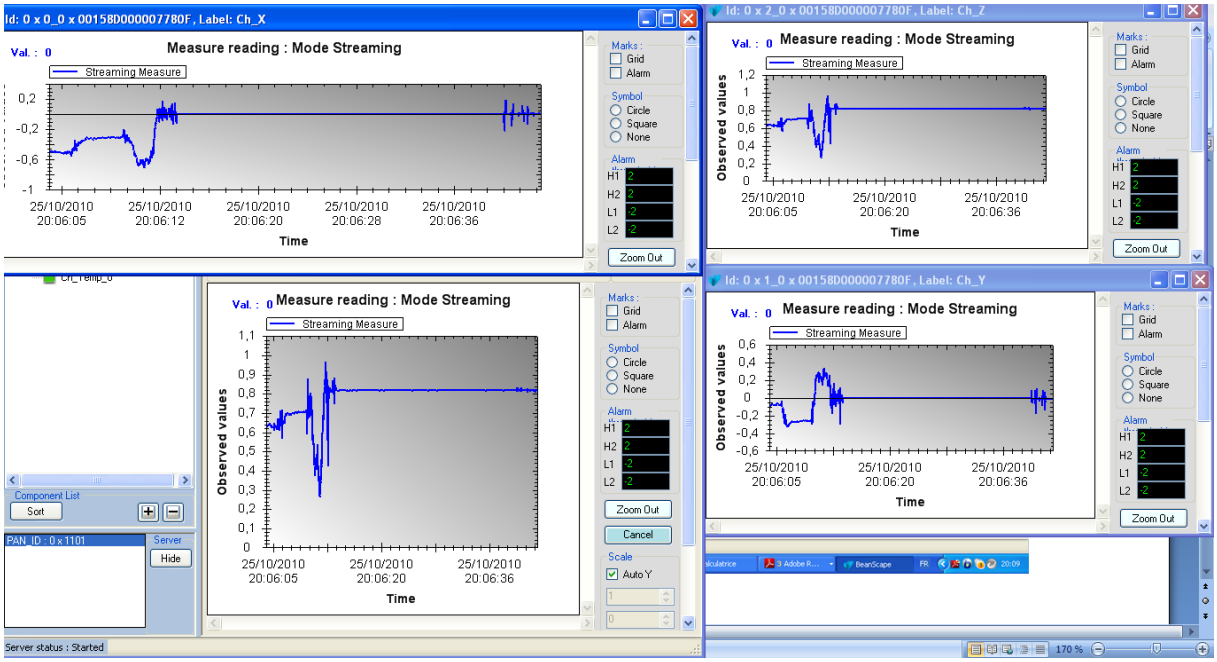



10.3.1.3 Open the graph in a new window

By clicking on "Open the graph in a new window", you can open a graph corresponding to your sensor.




You can easily open several graphs in a window.


Id: 0 x 0_0 x 00158D000007780F, Label: Ch_X
Measure reading : Mode Streaming
Streaming Measure
Time
Id: 0 x 2_0 x 00158D000007780F, Label: Ch_Z
Observed values
Id: 0 x 1_0 x 00158D000007780F, Label: Ch_Y
Zoom Out
Cancel
Server status : Started

***The multi-graph mode requires a lot of resources on your computer, it is recommended to install the BeanScape® software on a powerful computer.***

# 11. TROUBLESHOOTING

### *Why the Red LED is flashing?*

Each time a packet is lost by the BeanDevice®, Nwk/Activity led will blink in red. Try to decrease the wireless range between the BeanGateway® and the BeanDevice®.

### *Why the BeanDevice® LEDS are not activated?*

If there is no wireless network activity, the led will be inactive. Make sure you have powered your BeanDevice® with a charged battery.

### *What should I do if the radio channel is perturbated?*

Please turn off your BeanDevice ®, and then choose an appropriate channel. The channel selection is done from the BeanGateway ®.
For further information, please Read BeanGateway User's Manual BeanGateway ®.

### *Why the BeanDevice® does not provide the right measurement value?*

- Check if your sensor channel is activated on your BeanScape® interface (ON Position)?;
- Check if your BeanDevice® is powered up;
- Check your LQI quality, if your LQI is under 50-60. You must change your antenna position, or your product position;
- Check your data acquisition mode, maybe you have specified a data acquisition which is too long ;
- If you use a BeanDevice® AN-XX :
  - Check your sensor power supply, maybe you need to increase/decrease your power supply;
  - Check your sensor preprocess time. Maybe your sensor preprocess time is too short ?
  - Check the wiring code of your sensor plug ;

### *Why the BeanDevice® doesn't respond when I try to configure it (Over-the-air-configuration)?*

- ✓ If your BeanDevice® operates in sleep mode, the RF Hardware is also in sleep mode. Therefore an Over-the-air-configuration will not be possible.
- ✓ Check the LQI (Link Quality Indicator) value, if this value is under 80, the over-the-air configuration will not be easy. Try to decrease the wireless range between the BeanDevice® and the BeanGateway®.

- ✓ If your BeanDevice® works in streaming mode, in order to keep a full synchronization of the data acquisition, any over-the-air-configuration is authorized.

- ***Why do I have too much noise on my sensor signal ?***

  - ✓ If you use a BeanDevice® AX3D/HI-INC/AX-HD : don't forget to configure the cutoff frequency of your anti-aliasing filter
  - ✓ If you use a BeanDevice® AN-mV: use a shielded cable.

# 12. INSTALLATION PROCEDURES

## 12.1 SEALING

The product BeanDevice® comes with an ***IP66*** rating. So, do not install the BeanDevice® in a marine environment with high turbulence.
If you use the BeanDevice® AN-XX/TSI/TH, do not install the BeanDevice® up front to prevent the accumulation and infiltration of water from the front of the case.

## 12.2 COEXISTENCE WITH OTHERS FREQUENCIES AT 2.4 GHZ

The BeanDevice ® is sensitive to noise 2.4GHz (Wi-Fi as a source for example), but many protections are already in place, particularly in the IEEE 802.15.4®.
It should however be careful when installing the product, check all the possibilities of radio channels on the frequency range 2.4-2.5GHz. The operation of the product will be improved.

***For further information, read the application note: AN_RF_004 – "Coexistence And Interferences@2.4GHz"***

## 12.3 TEMPERATURE & HUMIDITY

The table below shows temperature operating of the different BeanDevice®:

| Product Version | Temperature range |
|---|---|
| *BeanDevice® AN-XX* | *-20 ° C to +75 ° C* |
| *BeanDevice AN-XX Xtender* | *-40 ° C to +85 ° C* |

BeanDevice® products can operate in an area with 90% humidity.
However, the wireless range can be reduced in the presence of water. Avoid mounting the BeanDevice® in an enclosure surrounded by water, or near bushy plants (plants are composed of 90% water), ...

## 12.4 REFLECTIONS, OBSTRUCTIONS AND MULTIPATH

*For further information, read the application note: AN_RF_007 :" Beanair_WSN_Deployment"*

### 12.5 SHOCK & VIBRATION RESISTANCE

Shock resistance on BeanDevice® products are:

| *BeanDevice® Type* | *Shock resistance* |
|---|---|
| *BeanDevice® AN-XX* | 10g during 50 ms |

Avoid dropping the BeanDevice®. BeanDevice® mechanical mounting on a wall, pole or on a DIN rail must be well performed.
***Do not force connections.***

### 12.1 ANTENNA

Check the LQI (Link Quality Indicator) of your BeanDevice® for being sure that your antenna is right oriented.

*For further information, read the application note: AN_RF_007 :" Beanair_WSN_Deployment"*